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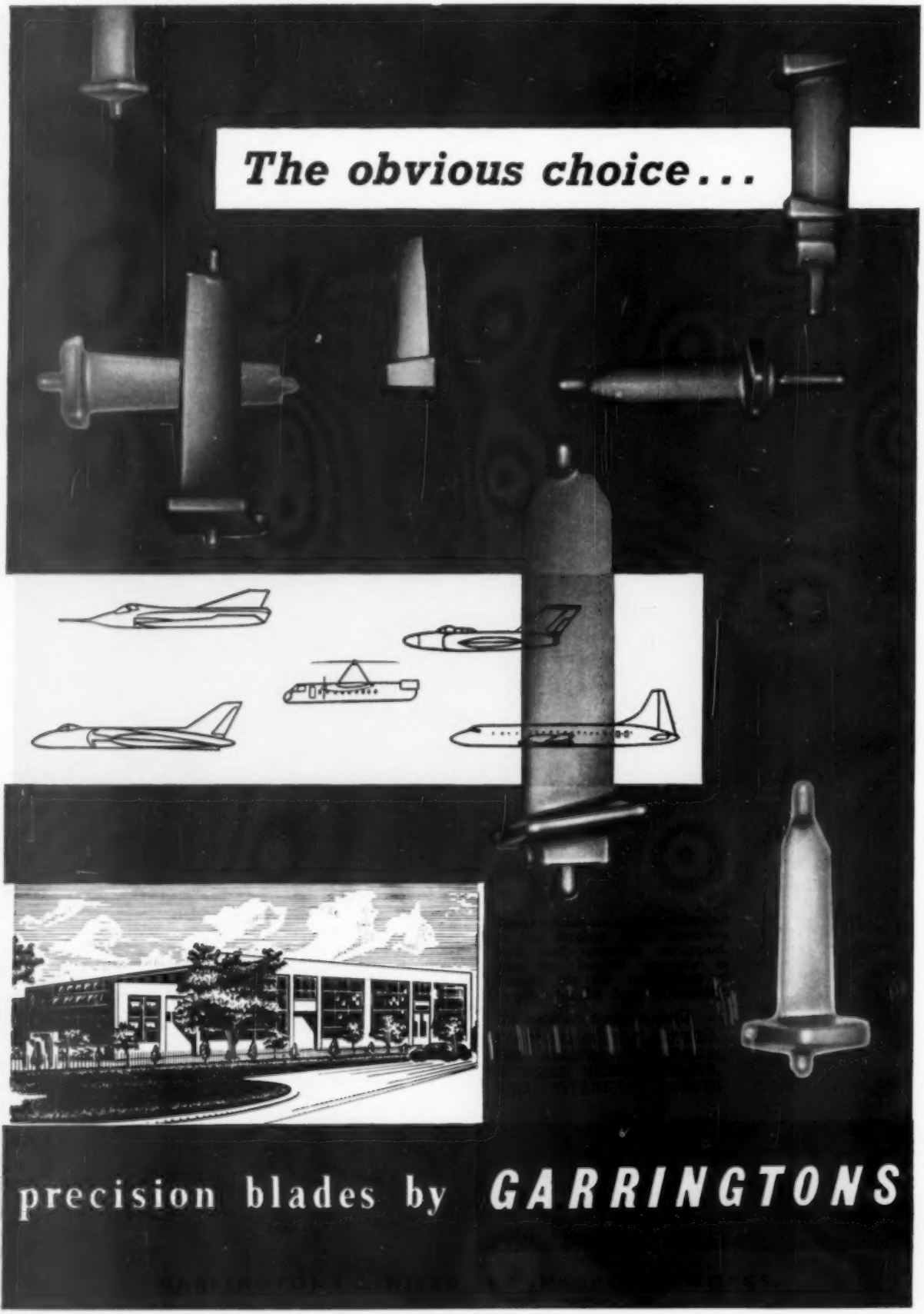
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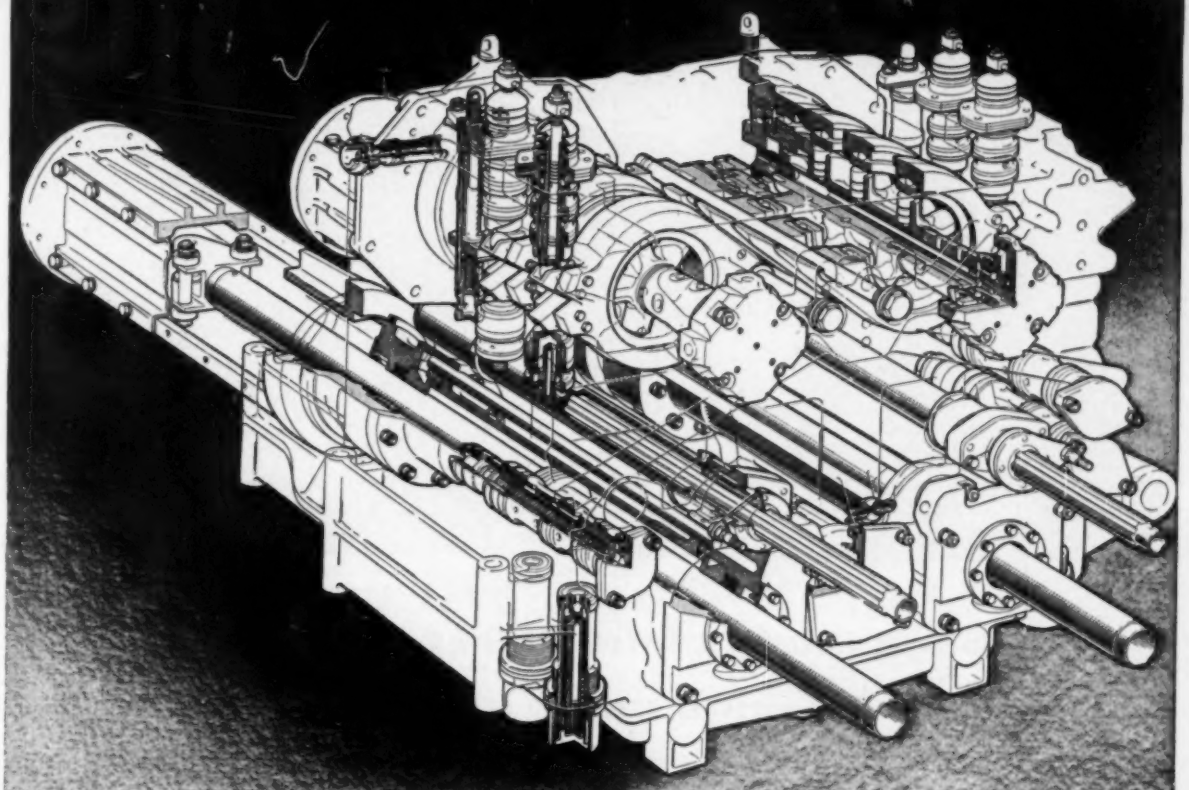

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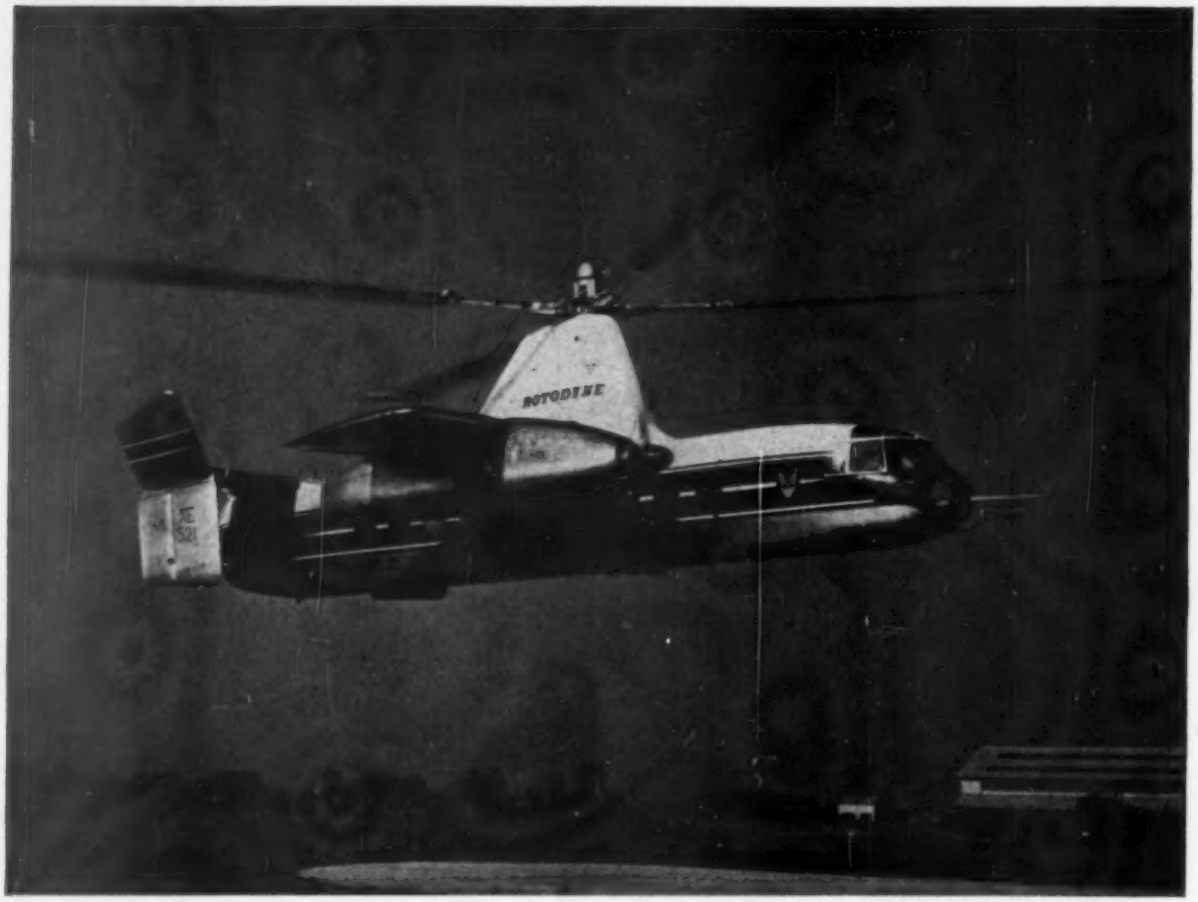
A

'FLUON' INCREASES PRODUCTION IN THE AIRCRAFT INDUSTRY



'Fluon' p.t.f.e. bearing rings made by Wills Pressure Filled Joint Ring Ltd., are used in the rotor blades of the 'Rotodyne' vertical take-off airliner designed and constructed by The Fairey Aviation Co. Ltd.

In each blade of the Fairey 'Rotodyne' there are 29 rings made from 'Fluon' p.t.f.e.

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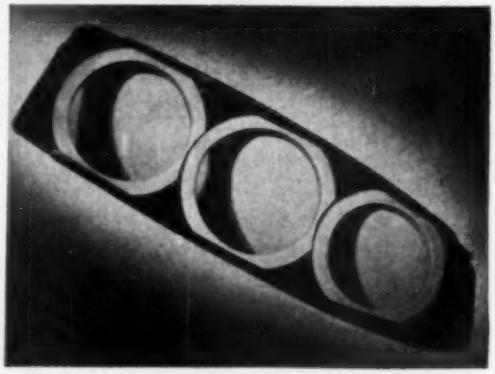

Cross section of blade showing the 'Fluon' rings.

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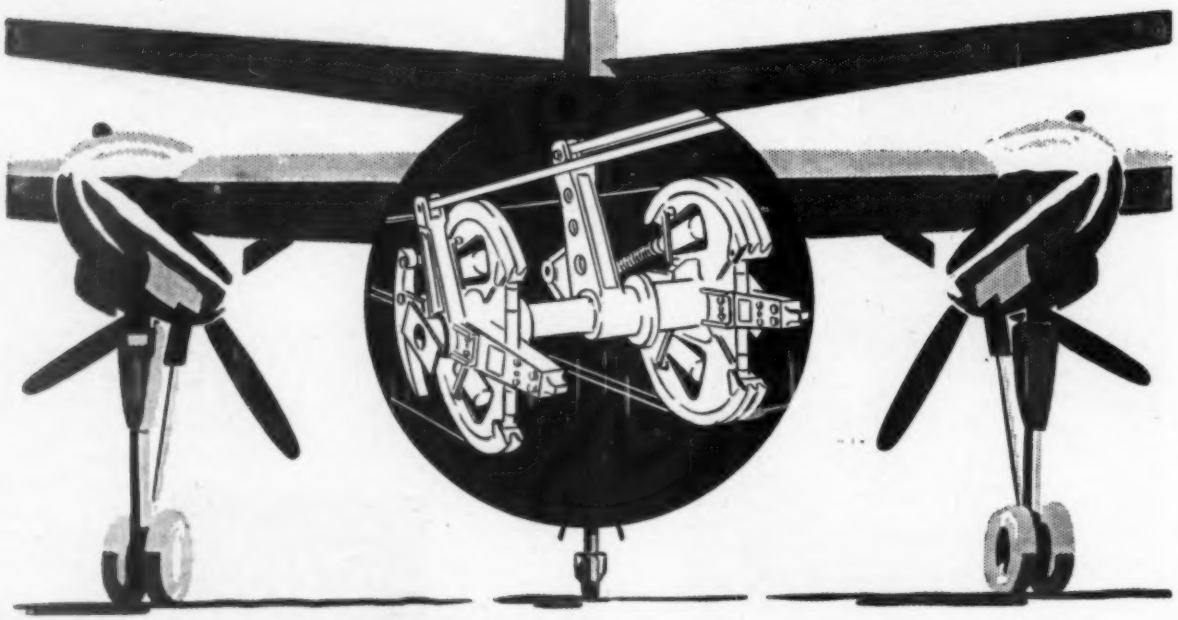

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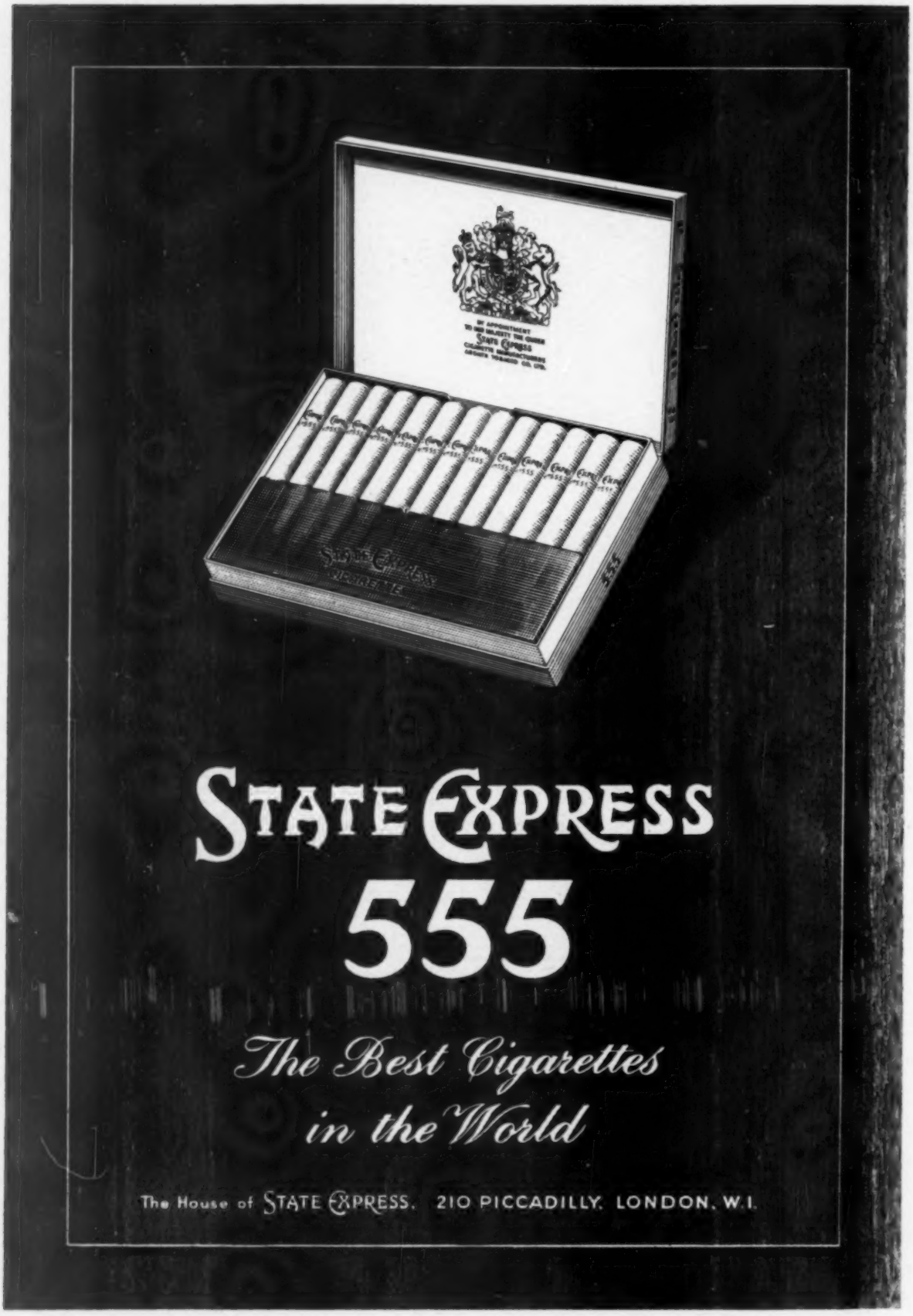
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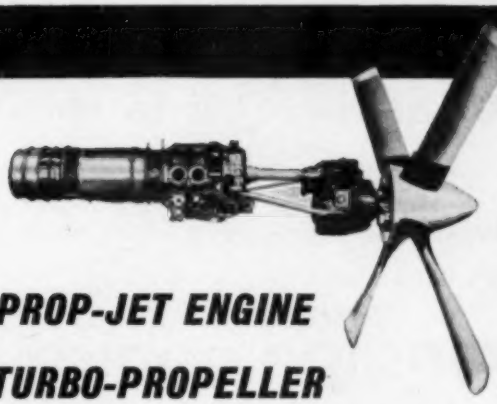

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Whatever the aircraft you can be sure it's fitted with

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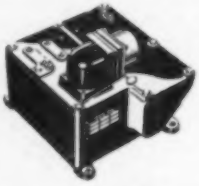

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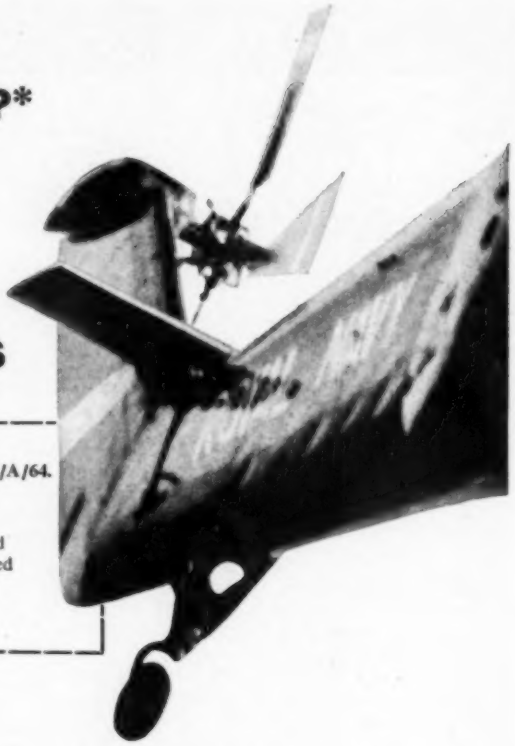

** See page 32 for answer.*

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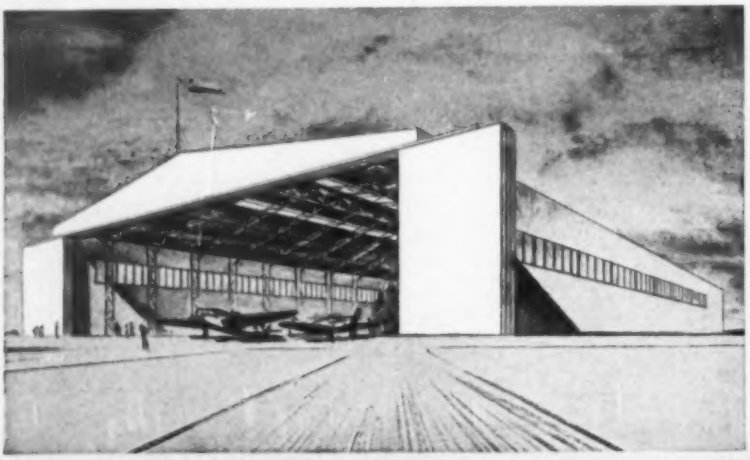

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B

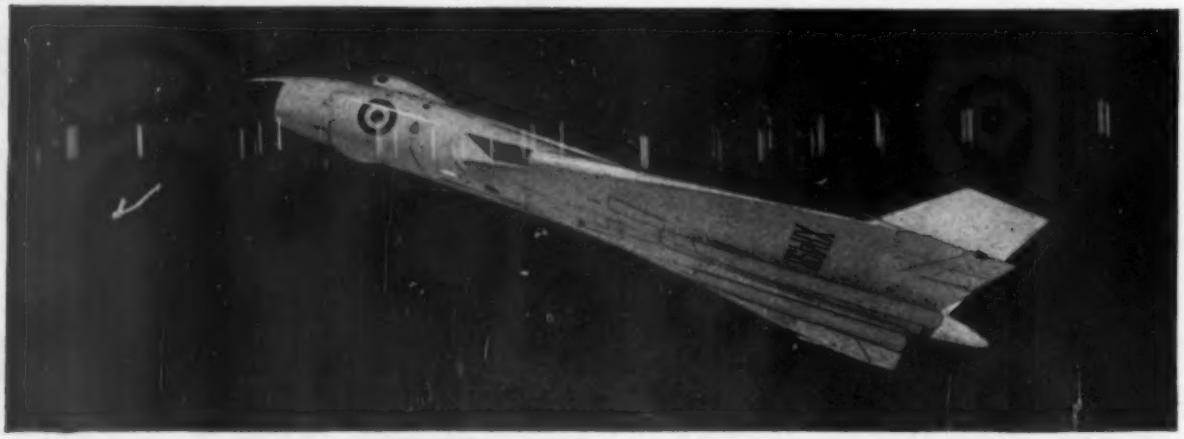
THE DAM BUSTERS ARE BACK

.... with VULCANS of course!

No. 617 Squadron, the most famous wartime unit in Bomber Command, is back. This squadron, which breached the mighty Ruhr dams in World War II, has now re-formed, and is equipped with the RAF's most potent bomber—the Avro Vulcan. It represents a great advance on 617's wartime Avro Lancaster. A single Vulcan, carrying nuclear weapons, has greater hitting power than the total bomb load of all 7,366 Lancasters produced during the war.

FLIES ATLANTIC IN THREE HOURS

A Vulcan of No. 617 Squadron, R.A.F., has crossed the Atlantic in 2 hrs. 59½ mins. It covered the 1943 miles from coast to coast at an average speed of 649 m.p.h., while flying from Goose Bay, Labrador, to Waddington, Lincs.



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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

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Maching On

OUR play on the august name of Dr. Ernst Mach must be forgiven; but it is worth reflecting on the manner in which the designers of military aeroplanes have consigned the fearful "sound barrier" to history. Ten years ago the fastest combat aircraft, either in squadron service or on the drawing board, were good for rather more than 600 m.p.h. During the ensuing five years the first operational aircraft began to thrust their noses timidly beyond the speed of sound —the "thunderclap hazard," as a British minister once described it—and now supersonic design is routine in many countries. Squadrons have already been formed of aeroplanes capable of exceeding Mach 2 in fighting trim, and one company, North American Aviation, Inc., is well ahead with the design of two giants for the U.S. Air Force which will reach or exceed Mach 3 (2,000 m.p.h.). Concerning these formidable programmes they say: "American industry faces a job that is big, demanding, urgent. The F-108 and the B-70 will be the first of the new generation of manned weapon systems. No military airplane in the world today even approaches their performance. They represent such a sharp break with the past that almost everything that goes into them—aerodynamic design, structure, propulsion, electronic and hydromechanical systems—will require giant forward strides in engineering."

It could be argued that the likelihood of a future full-scale, nuclear war is so remote that the whole pace of technical development could be arrested, and the millions of dollars for hypersonic weapon systems diverted to cancer research or new schools. At present, however, the United States thinks otherwise, and has no intention of slackening the pace. The U.S. Air Force has made a clear case for these two 2,000 m.p.h. aeroplanes, and for many even more advanced vehicles, such as the X-15 and Dyna-Soar. Development, conducted by teams in more than seventy companies to the pressure of a tight military schedule, cannot fail to produce workable systems at a relatively early date.

In Britain no ultra-high-Mach requirement is known to have been stated by any of the Services. There remains the Bristol T.188, described as "a steel research aeroplane," and it could well be that this vehicle is intended to probe the super-aerodynamics and slip-flow regimes of Mach 5 and above, like the soon-to-fly X-15. On the other hand, the T.188 could be intended to provide data on ordinary atmospheric flight at around Mach 3. If the latter is the case, we may be losing ground in the technical race. Hypersonics is fast becoming a field where, like Alice, one has to run furiously to stay in the same place.

Outdoing Mr. Fogg

WHEN the A.O.C-in-C. Transport Command, Air Marshal Sir Andrew McKee, took off from R.A.F. Lyneham in a Comet 2 of No. 216 Sqn. on November 10 his declared intention was to go round the world in a flying time of 81 hours and be back on December 2. On Tuesday last week—December 2—the Air Marshal landed at Lyneham, having completed his journey of some 32,000 miles in 72 hours' flying time. Not only had the de Havilland Comet arrived back on schedule, but it had reached each of its destinations—which included the first-ever landing by a Transport Command Comet at Hong Kong—on time.

Even in these days, when going round the world is no longer a Jules Verne adventure, and we are already talking in terms of Mach 5, this was no minor achievement. It underlines the splendid reliability of the Comet and the unobtrusive but impeccable work of the squadron which has done so much to put it back on the world air-transport map. Phineas Fogg circled the globe in eighty days; Sir Andrew has done it in fewer hours. Puck claimed he could put a girdle round about the earth in forty minutes; and perhaps fiction may again in future become fact, and 72 hours appear sluggardly for a passenger aircraft. Ten years ago even such a flight might have seemed fictional. Today it is splendid fact.

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VANGUARD, VENI, VIDI . . . The first Vickers-Armstrongs Vanguard was rolled off the production line at Weybridge on Thursday of last week. Its first flight is due to take place before the year's end, but no specific date has yet been announced

FROM ALL QUARTERS

Moon Rocket Off Course

AN attempt by the U.S. Army to send a rocket to the Moon, or even beyond it into orbit round the Sun, was made from Cape Canaveral at 5.45 a.m. G.M.T. last Saturday. It proved unsuccessful.

Juno II, a four-stage vehicle, was employed to lift a 13-lb conically shaped instrument package made of gold-plated glass-fibre. The first stage of the 76ft-high assembly was a 60-ton Jupiter elongated to increase its content of liquid fuel; the second was an annular cluster of 11 scaled-down solid-fuel Sergeants weighing a total of 721 lb; the third, three Sergeants weighing 207 lb; and the fourth, carrying the payload, one scaled-down Sergeant weighing 59 lb.

The vehicle went off course shortly after launching—owing, it was said, to a wrong fuel-valve setting—and fell back, to burn out in the atmosphere, 38 hours later. It had reached some 66,650 miles.

Other space news last week was that the rocket of the third Soviet sputnik "ceased to exist" on Wednesday, December 3, after completing 2,907 circuits; and that the U.S.A. is to launch a 1,300 lb artificial satellite in the near future under a new programme known as Project Discoverer.

Shock-waves at Westminster

THE fact that American air bases in Britain brought £90m a year into the country—£39m more than the car industry, the biggest dollar-earner—was revealed by Mr. Orr-Ewing, Under-Secretary for Air, in Parliament last Friday. He was replying for the Government in a debate on military-aircraft noise. Mr. B. Harrison (Con., Maldon) had moved a resolution calling on the Government to "reduce inevitable disturbance and ensure that compensation claims are dealt with promptly and fairly." He and other Members, both Conservative and Labour, gave examples in support of their plea.

Mr. Orr-Ewing said that the subject of shock-wave damage was being investigated at a research station near Watford, but much more work was required.

In the past two years there had been 824 claims for damage from sonic bangs, and 221 payments had been made, amounting to over £2,000. About one-third related to "unidentified bangs."

Jetstar Orpheus

LAST week we published a photograph of an Orpheus turbojet being packaged by Bristol Aero-Engines for delivery to the Lockheed Aircraft Corporation for installation in a Jetstar transport. The performance of the Orpheus in the Jetstar has been a telling advertisement for British engines.

Two Jetstars have so far flown, the first taking the air in September 1957 and the second in March 1958. Both aircraft are powered by TJ-37 engines, which are Orpheus 810s manufactured by Bristol and supplied by the Curtiss-Wright Corporation. In the two Jetstars these engines have given exemplary performance; estimated performance has been met or exceeded, an aircraft top speed of 613 m.p.h. has been established, total aircraft mileage exceeds one-third of a million miles, and there has not yet been a single unscheduled engine removal due to an engine fault. The Orpheus 810 is specially tailored to the Lockheed transport. Provision is made for fitting as standard equipment an Eclipse-Pioneer 12 kW starter/generator and a New York Air Brake hydraulic pump; the intake is fully anti-iced and air can be bled for cabin-pressurization and windscreen-heating. Simple Check-1s, comprising a brief examination of the nacelle and jet-pipe and topping-up of the oil tank, are undertaken once every hundred hours; the guaranteed initial life between overhauls is 500 hr, and by 1962 this is expected to exceed 1,000 hr.

Following are some performance figures for the Jetstar powerplant: fully equipped dry weight, with intake and all accessories, 980 lb; maximum sea-level thrust, 5,100 lb at 10,000 r.p.m. (s.f.c. 1.09); maximum continuous at sea level, 4,130 lb at 9,350 r.p.m. (s.f.c. 1.06); maximum continuous at 36,000ft at Mach 0.77 (510 m.p.h.); 1,395 lb thrust at 9,350 r.p.m. (s.f.c. 1.28).

SeaMaster Cut

ALMOST the sole survivor of the flying-boat race, the Martin P6M SeaMaster will not now see extensive service. The original concept specified a high-subsonic machine weighing 160,000 lb, intended for minelaying, reconnaissance and numerous other open-sea military duties for the U.S. Navy. Both the XP6M-1 prototypes crashed after suffering mechanical failure. Six YP6M-1 development aircraft, each powered by four Allison J71s with afterburners, are at present in the Navy's hands; the

VICI . . . Another view of the Vanguard on the foggy day of the roll-out. This aircraft will be used as a Vickers demonstration model and for flight-tests. Following close behind will be the first five V.951s for B.E.A. and a 952 for T.C.A.

development contract was for $175,593,180. The production order, for $114.5m, covered the purchase of 24 P6M-2 aircraft, each powered by four Pratt and Whitney J75s. The Navy have now announced cancellation of 16 of these aircraft. The eight -2 production aircraft which will be delivered are to form an operational squadron with the six Allison-powered YP6Ms.

Voodoo Increment

FIVE F-101 McDonnell Voodoos reached the U.S.A.F. base at R.A.F. Bentwaters, Suffolk, on December 4 after covering 5,550 miles from the United States in 10½ hours' flying time. They had left Shaw A.F.B., Cal, on the previous morning; had been air-refuelled twice over the Atlantic; and had then landed at Nouasseur, in Morocco, flying from there to Bentwaters—a distance of 1,380 statute miles—non-stop without refuelling. Originally eight were due to arrive, but a flight of three had put down at Bermuda after two had experienced air-refuelling trouble.

The aircraft which arrived on December 4 formed "the first increment"—in the words of the Third Air Force—of a total of "some 75" Voodoos which are due to arrive by mid-January and will replace the F-84F Thunderstreaks at present operated by the 81st Tactical Fighter Wing, whose H.Q. is at Bentwaters.

Percy Bryan

WE record with regret that Mr. Percy F. Bryan, A.F.R.Ae.S., who had been manager of the aircraft design division of the de Havilland Aircraft Co. since July 1956, died on December 3.

Mr. Bryan

Percy Bryan joined the D.H. design staff in 1933, becoming chief draughtsman seven years later and carrying a heavy wartime responsibility in respect of the many versions of the Mosquito. After specializing in the administrative side in post-war years he became design department manager in December 1954, a year and a half before assuming his divisional post.

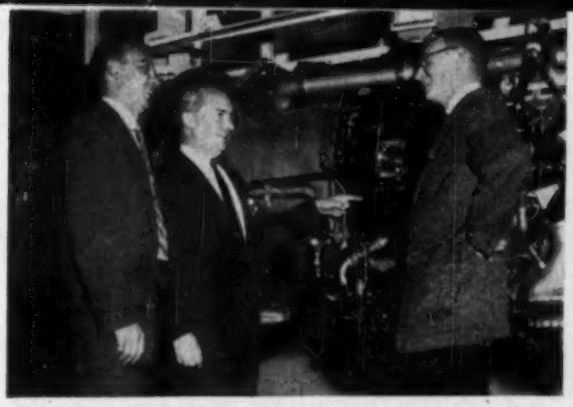
His aeronautical experience dated from the early 1920s, for when apprenticed (1920-25) to the Air Navigation and Engineering Co., Ltd., he worked with Mr. W. S. Shackleton on a light aircraft—the A.N.E.C.1 (700 c.c. Blackburn inverted vee-twin)—which tied for the *Daily Mail* prize of £1,000 for the greatest distance that could be flown on a gallon of fuel. He had further experience as a design draughtsman on airframes with Beardmore (1925-27) and on engines with Bristol (1927-28), then became chief draughtsman of the Larkin Aircraft Co., Ltd., Melbourne, again under Mr. Shackleton, with whom he worked in England on light aircraft in 1932 before joining D.H. His colleagues there have paid warm tribute to his integrity, perseverance and delightful companionship.

E.T.P.S. McKenna Dinner

THE graduation of No. 17 Course from the Empire Test Pilots' School at Farnborough was marked on Thursday of last week by the traditional McKenna dinner. After proposing the health of the guests, G/C. R. E. Burns, the Commandant, took up the question of the possible demise of E.T.P.S. under the general wave of economies. He observed that the work-load of the research and development establishments would probably remain constant for the next two years and then decrease by 30 per cent during 1961. But this would not entail an equivalent reduction in test-pilot strength because a higher proportion of each pilot's time would have to be spent on the ground, preparing for test flights. The next E.T.P.S. course, with 28 students, would be smaller; but those now graduating could look forward to an interesting three-year tour of test flying.

The guest of honour, Air Chief Marshal Sir Claude Pelly (Controller of Aircraft, Ministry of Supply), in his reply on behalf of the guests was able to assure G/C. Burns that a great deal of test-flying still remained to be done. Development flying of the Lightning had only just begun, as had that of the NA.39. There was still much to do with the Scimitar, and development flying of the Mk 2 versions of the V-bombers had not even started. Much would also be required for helicopters, VTOL and STOL and transport aircraft, and possibly the OR.339. Of the latter he said, "I'll bet that's coming too!" The E.T.P.S. fleet of aircraft would be reorganized by the time the next course started, to provide a more representative selection of types. As for the disbandment or removal of the E.T.P.S. to another base, he said that plans for the construction of a new mess at Farnborough could be confidently put in hand.

Sir Claude then presented the McKenna Trophy to F/L. Chandu Golé, Indian Air Force, and the newly instituted Edwards Award to F/L. R. A. Whyte, R.A.F. The Award has been donated by the flight test school at Edwards A.F.B., Cal., to go to the student making the greatest progress during his course. F/L. Golé presented a silver champagne bucket to the P.M.C. on behalf of the members of No. 17 Course.



***CONWAY IN CALIFORNIA:** Mr. A. A. Lombard, a director of Rolls-Royce, Ltd., and director of engineering of the company's aero-engine division, is in the centre of this group inspecting the first Conway by-pass turbojet to be delivered to Douglas Aircraft. On the left is Mr. A. E. Raymond, senior vice-president (engineering) of Douglas, and also in the picture is Trans-Canada Airlines' contract representative, Mr. L. K. Rutledge. Conways are due in the ninth DC-8 off the line*

Meetings and Discussions

NEXT week's meetings of the learned societies include a Royal Aeronautical Society discussion on hypersonic flow next Monday, December 15. Held in London at the Institution of Mechanical Engineers, it will be an all-day meeting, and introductory papers will be read by Mr. R. J. Monaghan, Prof. M. J. Lighthill, Messrs. R. N. Cox, K. W. Mangler and L. F. Crabtree, Dr. D W. Holder, and Messrs. J. A. Shercliff and T. R. F. Nonweiler. Admission is by ticket only.

The next main lecture of the R.Ae.S. will be on Thursday, the 18th, when Mr. E. W. Pike will give a paper on *Air Traffic Control over the North Atlantic.*

In Washington, on December 17, this year's Wright Brothers Lecture is being given by Prof. Maurice Roy, the eminent French authority; his subject will be *Means and Examples of Aeronautical Research in France.* Also being held in America, on the 16th, is the Convertible-aircraft Conference at Philadelphia.

In London, on December 17, an annual event of more "popular" appeal will be the Aircraft Recognition Society's December forum. Questions from the audience will be discussed by a distinguished panel consisting of Mr. Peter Masefield, Sir Arnold Hall, Mr. Robert Lickley and Mr. Peter Brooks, with Mr. E. Colston Shepherd in the chair. "Readers of *Flight* are invited," says the Society; the venue is the R.Ae.S. library at 4 Hamilton Place, London, W.1, and the time is 7 p.m.

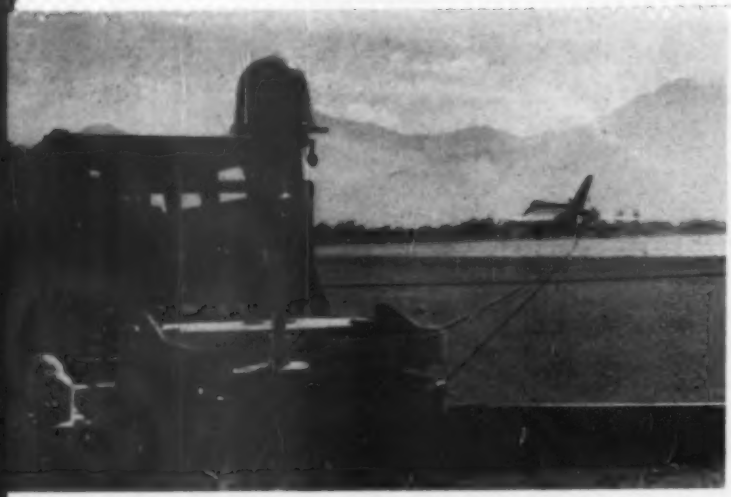
Scimitar Accident Repercussions

AN agreed statement between the Admiralty and the coroner for south-east Hampshire, Mr. R. N. Sherwell, was issued on December 4. This followed allegations by Mr. Sherwell that the jury at the inquest on Cdr. J. D. Russell, pilot of the Scimitar which went over the side of H.M.S. *Victorious* on September 25, had been "bamboozled" as they were not told the reason why an arrester wire on the carrier broke "because the Naval authorities had concluded that it would not be in the national interest." After the inquest, an Admiralty spokesman issued a statement giving the reason for the failure; and Mr. Sherwell said he considered the Admiralty owed him an explanation. The agreed statement was as follows:—

"Owing to a misunderstanding the coroner was under the impression that for security reasons the technical evidence relating to the defective valve of the arrester wire ought not to be given in court. The coroner was shown, as a matter of courtesy, and in accordance with established procedure, the board of inquiry findings, but he was asked to ensure that this document should not be produced in court on the grounds of public interest. This is normal practice but is not based on considerations of security.

"Although the findings of the board of inquiry as such were not to be disclosed in court, Admiralty witnesses, who could have given technical evidence explaining the reasons for the failure of the arrester wire, were available if required, but the Coroner was not aware of this. The Admiralty had no intention of withholding evidence about the reasons for the failure of the arrester wire which could have assisted the jury in arriving at a decision. That is why Press inquiries on the subject to the Admiralty were immediately answered. The Coroner is now quite satisfied with the position and does not propose to take any further steps."

As we briefly reported last week, the jury returned a verdict of accidental death. Overleaf will be found a considered résumé of the available facts relating to the accident.



MOREST is the name of new arrester gear now being used by the U.S. Navy on short runways. Making use of hydraulically braked winches it operates broadly on the principle of a carrier-borne arrester wire. It is here seen checking one of the F4D Skyrays in service with Marine Air Group Eleven in Formosa

FROM ALL QUARTERS . . .

The Scimitar Accident

DURING and after last week's Gosport inquest on Cdr. J. D. Russell, R.N., former C.O. of No. 803 Sqn., who lost his life when his Scimitar went over the side of H.M.S. *Victorious* in the Channel on September 25, some details were given of the sequence of events which led to his death. The squadron was coming aboard the new carrier and Cdr. Russell had made a series of normal "touch-and-go" approaches preparatory to making the first arrested landing. In this he made a normal touch-down and caught the first arrester wire; but, when the aircraft had almost stopped, the wire snapped and the aircraft rolled very slowly forward and toppled off the end of the angled deck into the sea. It remained afloat for a surprisingly long time and Cdr. Russell was seen to be operating various controls and removing his head-gear while an airman was lowered towards the aircraft from the plane-guard helicopter. The cockpit canopy momentarily opened and then slid shut again just before the aircraft sank out of sight with the pilot still on board. During a subsequent search of the area no trace of him could be found. Intensive salvage operations, frequently hampered by strong tides and bad weather, resulted in the recovery of the forward portion of the aircraft about a month later, together with the pilot's body.

Press photographers aboard *Victorious* at the time of the accident took pictures and film which were widely publicized in newspapers and on television. Mainly because of this, and of the puzzling failure of the pilot to leave his aircraft, the accident has attracted considerable attention.

From the evidence given at the inquest, and from facts made known by the Admiralty, the sequence of events is now fairly well established. It is clear that Cdr. Russell's death was the result of a combination of circumstances, each of which contributed towards final disaster. Firstly, the arrester wire broke because a small valve in the hydraulic decelerator gear was left open and this was not detected during normal testing of the system. (The traditional test procedure of pulling the wire out with a tractor is now to be changed.) When the wire broke the aircraft had almost stopped, but no attempt was apparently made to stop it finally or to steer it away from the edge of the deck. The pilot could almost certainly have braked to a standstill had he realized what was happening, but his attention was probably occupied by the checks which have to be carried out very quickly at that juncture.

The aircraft having settled in the water close alongside the carrier, and with the helicopter on the spot, the pilot's chances of a successful escape by climbing out into the water seemed excellent. All he had to do, in theory, was to get rid of the canopy, either explosively or manually, undo the quick-release box on his combined parachute/seat harness to detach himself from seat and parachute, remove his helmet and his dinghy-pack attachments, and unfasten the leg-restraint quick-release buckles.

In the event, it has been established that he was unable to pull the canopy-jettison handle because it became fouled. (The handle has already been redesigned.) The alternative in such cases is to use the ejection seat, but this Cdr. Russell certainly did not attempt at any stage. It may be that he felt he had precluded this by undoing his harness, possibly in order to get closer to the lever, or that he still considered that ejection was unnecessary. He may also have thought that the helicopter was too close overhead to permit ejection. In fact, he continued to try to open the canopy by sliding it back manually; but this would have been difficult, because the weight of the canopy tends to close it when the nose of the aircraft is down. He was seen to slide it some way back, but it slid closed again.

By this time water must have been entering the cockpit through the inward-relief system which is specifically intended to admit water to balance internal and external pressures and make underwater canopy-opening easier. All Cdr. Russell's breathing air was reaching his mask through the supply tube; therefore, when the water level reached the regulator, water would flow to his mask and force him to spend time in removing his headgear. This he was seen to do. A regulator setting for breathing 100 per cent oxygen would have excluded water from the system and increased his endurance, but it seems likely that his energies had been very considerably taxed by the struggle with canopy and headgear by the time the aircraft finally sank. He very probably did manage to open the canopy manually underwater (though it might have slid back after a change of aircraft attitude) but he did not release his leg-restraint straps. He remained held in the cockpit, though not necessarily by the leg-restraint gear.

On the Martin-Baker Mk 4 ejection seat fitted in the Scimitar the leg-restraint straps pass from the shear rivets on the floor, through snubber boxes, through D-rings on the pilot's garters and to attachments on the seat-pan which are unlocked either by the automatic sequence of ejection or by the manual operation of the override lever. This also unfastens the harness from the seat. After landing normally or ditching, the pilot leaves the seat by undoing the combined parachute/seat harness and detaching the D-rings on his garters by spring-loaded quick-releases. These were found to be in full working order after salvage, and it seems certain that Cdr. Russell did not reach the stage of undoing them. He had almost certainly spent much time and energy in overcoming earlier difficulties.

The Admiralty has stated definitely that in this accident, and in a subsequent unsuccessful ejection from a Scimitar near Lossiemouth (see "R.N. Scimitars Cleared," p. 925), no fault was found in the Martin-Baker ejection seats.

Strategic Studies Institute

KNOWN as the Institute for Strategic Studies, Ltd., a new body on an international basis has been formed for the study of defence and disarmament. It is to have headquarters in London and the initial finance for its first three years of operation has been generously provided by a grant of $150,000 from the Ford Foundation in New York. The first director will be the Hon. Alastair Buchan and its secretary Cdr. H. E. B. Jenkinson, R.N.(ret.).

The Institute's purpose is to further the study of strategy and security as a whole and its membership will not be confined to British subjects. The founder-members of its council are, however, all drawn from Britain. Sir Kenneth Grubb is chairman, the vice-chairman is Richard Goold-Adams and Lord Salter is treasurer. Other members include Marshal of the R.A.F. Sir John Slessor, the former Chief of Air Staff, and Air Chief Marshal Sir Ronald Ivelaw-Chapman, former V.C.A.S.

Technological Trust

THE CIBA organization—of which CIBA (A.R.L.), Ltd. (formerly Aero Research, Ltd.) is a member-company—has announced the founding of the CIBA Fellowship Trust, for the purpose of encouraging the interchange of ideas between British scientists and those of Continental countries.

The trustees are Sir Arthur Vere Harvey, M.P.; Lord Hives; and Prof. Sir Alexander R. Todd. The Fellowships will be awarded by an advisory panel consisting of Sir Arthur Vere Harvey (chairman); Prof. A. J. Birch, University of Manchester; Prof. W. Bradley, University of Leeds; Dr. A. Brunner, CIBA, Ltd., Basle; Dr. E. Brunner, the Clayton Aniline Co., Ltd., Manchester; Prof. D. H. Everett, University of Bristol; Prof. D. M. Newitt, University of London; and Dr. R. F. Webb, CIBA (A.R.L.), Ltd., Duxford.

Several Fellowships are to be awarded for tenure during the academic year 1959-1960 at Continental universities or institutions "for research in chemistry, physics or some other allied scientific subject." They will be awarded to graduates of universities situated in the United Kingdom or in the Republic of Ireland, or to members of such universities graduating this year. It is expected that some Fellowships will be awarded to recent graduates, and others to candidates who have already taken their Ph.D., or who have already spent some time in industry.

The basic award for Fellows who have been undertaking training in research and who wish to continue post-doctorate studies will be £800 per annum, plus allowances. For candidates who have obtained a First in science and who wish to undergo training in research the basic award will be £500 per annum, plus allowances.

Further details are available from the Secretary of the CIBA Fellowship Trust, CIBA (A.R.L.), Ltd., Duxford, Cambridge.

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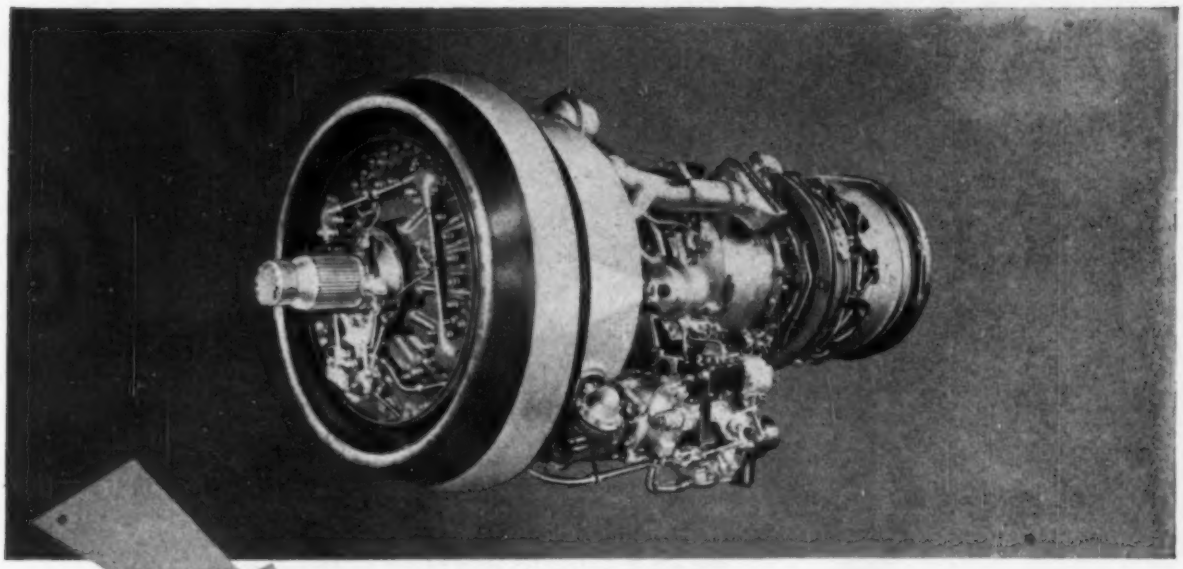

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Canberra for Missile Trials

SHORT'S DEVELOPMENT OF THE U.10

JUST before the last S.B.A.C. Display, Short Brothers and Harland, Ltd., announced the development of the Canberra U.10 as a pilotless, remote-controlled aircraft for use in missile trials. Firefly and Meteor drones have for some years been used for this type of work and it was logical to suppose that the Canberra might also be adapted for such duties in order to provide a drone with higher performance and longer range. Flight tests have been under way for some time and several machines have been completed and delivered. One has been sent to Australia.

The Canberra U.10 is intended to fly automatically out of sight of the controllers on the ground. In order to obtain optimum performance under these conditions the control system was arranged to maintain the aircraft in one of a number of pre-set, autopilot-controlled attitudes following reception of one of a series of V.H.F. radio commands. When set for "climb," the aircraft gains altitude within the range of speeds recommended for the basic Canberra. The "slow level" flight setting provides maximum endurance when needed. "Fast level" flight closely matches maximum cruising speed for the manned aircraft, although a variable-airspeed facility has been added to allow selection of any airspeed in the higher part of the speed-range. "Fast glide" is a compromise between maximum rate of descent and ground-control surveillance requirements. The Canberra can attain a very high rate of descent if required. "Land glide" governs a constant approach speed, while "overshoot" virtually reproduces the manned missed-approach procedure. "Emergency approach" has been evolved by Shorts to anticipate the unlikely event of a flame-out in one engine.

Remote control during normal flight is maintained from a ground master-control position. During landing and take-off, the master controller can hand over to two operators respectively controlling pitch and azimuth, but he retains the facility to override these positions if required. The master controller can select any of the pre-set attitudes and can also initiate turns or height adjustments within these fixed régimes.

The commands are transmitted by V.H.F. radio to an airborne receiver and passed to an R.S.R. (relay set receiving) through a selector filter and relay unit. According to the command selected, appropriate relays in the R.S.R. initiate the required autopilot mode, airspeed and throttle settings and other controls. Some functions are automatically initiated without radio command, especially where safety limits are involved. For example, the undercarriage is automatically raised at speeds above 160 kt.

The aircraft can be destroyed in flight by a command which, in addition to passing through the normal receiver, will be picked up by an independent receiver with its own power source. An explosive charge is in this case detonated to blow off the tail of the drone.

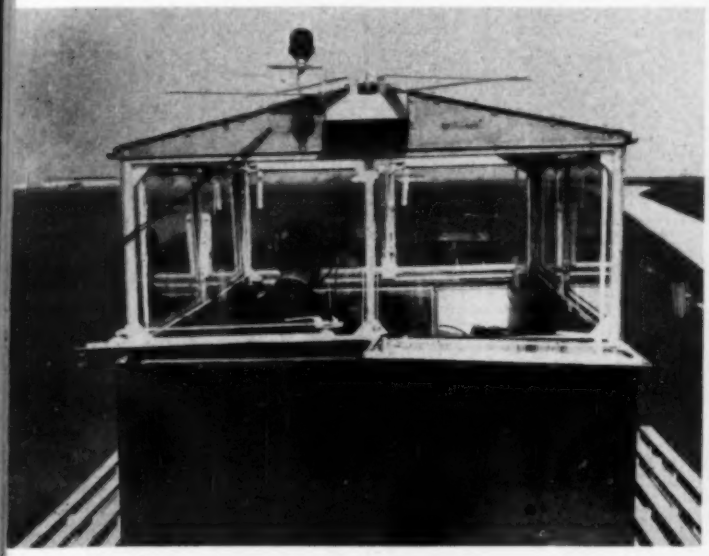
A "control supervisory unit" in the cockpit can be used for supervising automatic flight in the air when a pilot is carried. It consists of a series of control buttons and associated indicator lamps, generally similar to those used by the ground master controller. Operation of these buttons produces the same effect on the aircraft as the corresponding ground-control command without using the radio link, so that the aircraft can be flown as a drone by a human pilot.

To provide performance and navigational information to the ground master controller a 24-channel telemetry transmitter and an M.T.S. (missile tracking system) are carried. Since all operations will be conducted under radar control, a transponder beacon is also fitted to strengthen radar return from the aircraft.

The complete control system can be divided as follows: (a) internal control loop in operation during steady flight in a fixed attitude, consisting of autopilot, automatic airspeed and throttle control and the aircraft; (b) external control loop consisting of ground controller(s) navigational information or visual sighting, signal generating equipment, radio link and the aircraft; (c) ancillary controls, e.g., landing gear, flaps, etc.; (d) telemetering and tracking installation.

[*Continued overleaf*

(Left) The main controller's position for monitoring the U.10 in normal flight. (Right) Inside the control station which transmits his commands



Left, the azimuth controller, who works in conjunction with the pitch controller to direct take-off and landing. If necessary the master controller can override them both

Right, test pilot S/L. D. R. Turley-George (centre) checks the flight programme with his test observers, M. J. Palmer (left) and W. D. Monteith

CANBERRA FOR MISSILE TRIALS . . .

Automatic three-axis control is provided by an Elliott Brothers (London) autopilot consisting of yaw, pitch and roll units, three electric servos, an instrument unit and a junction box. Control units, pilot's cut-out switch, inverter, and transformer complete the installation.

The pitch and roll units are secured to platforms which can be tilted to align with pitch and bank angles demanded by the controller. In addition to its gyroscope, the roll platform carries a horizon gyro unit and a turns computer and operates a bank-sense switch which connects the output of a height-displacement integrator to the aileron channel during roll displacements in level flight. The horizon gyro unit is fitted with pitch and roll pick-offs and provides long-term vertical reference. The output of a capacitance system provides a displacement signal which, at 110 kt, is connected to initiate automatic unsticking during take-off.

An airspeed and throttle control system produced by Ultra controls airspeed and altitude in accordance with fixed attitudes selected by the command link. Certain airspeed command and altitude reference voltages are also supplied for use outside the airspeed-control system, e.g., for undercarriage retraction. The main units of this system are the airspeed instrument, airspeed control amplifier, height lock capacity unit and throttle actuator.

The R.S.R. contains miniature sealed relays and condensers and is specially designed to form the link between the command radio receiving equipment and the automatic controls forming the internal loop. It also links certain ancillary controls with the appropriate initiating equipment.

The fixed attitude signals are in a locking chain in the R.S.R., so that a command causes the appropriate relay to operate and also to cancel any of the others which may have been operated earlier. Once selected, an attitude remains in force until cancelled by another selection. There are four other locking signals, "Straight" (which remains operative until cancelled by a turn demand), "Fuel Off," "Flaps Up" (for emergency operation) and "Destroy."

Commands for right or left turns and nose up or down are non-locking ("beep") signals and remain in force only while the ground-controller holds down the appropriate switch. They, therefore, serve to modify the basic fixed attitudes. Normally the attitude reached by beeping is maintained until modified by further beeping or a new fixed-attitude signal, but in "Land Glide" the "Straight" mode is automatically re-established after each turn demand.

During normal flight the transmitter on the ground passes commands to the aircraft by means of a series of pairs of tones. As each tone pair is received in the aircraft, it is routed by means of tuned filters to the appropriate relays in the R.S.R. and initiates the required operation. The tone generator can produce 24 tone pairs, avoiding certain adjacent combinations which could otherwise prove embarrassing. The ground installation includes a replica of the airborne receiver so that the transmitted signals can also be received and monitored on the ground to ensure correct operation.

During the course of an operational sortie the Canberra U.10 will be controlled successively in three different ways, according to the phase of the operation in progress. Normal flight covers all conditions other than take-off or landing. The aircraft is controlled by its internal loop and will continue flying in a particular mode unless instructed to change it by an external command. Commands create discrete changes of condition, and are used to alter the phase of the flight plan or to correct any deviations from the required performance shown up by radar plotting or telemetering.

During landing, the aircraft in its current form is controlled by pitch and azimuth operators, at optical sighting positions on the airfield, who transmit signals to maintain the aircraft on a pre-determined glide-path. For take-off, optical sighting is used for azimuth control, while pitch is controlled by the internal loop in accordance with a pre-set programme.

Overall responsibility throughout a sortie rests with the master controller. He can hand over to the optical-sight operators during take-off and landing but personally transmits the fixed-attitude and beep signals. He is also responsible for the navigation of the aircraft, with the co-operation of the radar network. The operational team therefore consists of a master controller, pitch-sight controller, and azimuth-sight controller.

For recovery, the aircraft is set in the "slow level" mode and fed into the approach pattern by radar or tracking control or a combination of both. A glide-path angle of 2 deg is used, so that the aircraft is at 1,000ft when 5 n.m. from touch-down. The let-down is made in the "fast glide" mode, levelling off at 2,000ft and descending to 1,000ft under beep control in the "slow level" configuration. At about seven miles, the "land glide" command is selected and the aircraft enters the glide-path at about five miles. The ground operators will probably be in visual contact at this point; should this not be so, the master controller will monitor the aircraft down the glide-path by reference to radar and telemetering information until visual contact is established. Once the ground operators have the drone in sight, control is passed to them and the approach is completed under their guidance. The option to overshoot is retained by the master controller throughout. The aircraft flies onto the ground directly from the glide-path, and the combination of approach speed, rate of sink and glide-path angle have been carefully selected to allow this. No flare-out is necessary, but the pitch-sight operator generally does check the aircraft slightly. Direction is controlled during the landing run by the azimuth operator, who has differential-brake and rudder control for this purpose. The Maxaret braking system and a drag 'chute operate automatically, and a "fuel off" command is originated by the master controller to stop the engines.

The first Canberra U.10s have the basic British drone-control system developed by R.A.E., Farnborough, but a number of landing systems capable of fully automatic operation have also been investigated. A development now being considered is based on an optical line of sight locked-on to the aircraft by the ground operator and transmission of error signals through a standard I.L.S.-type transmitter. Lock-follow radar could be substituted for the optical sighting equipment to achieve fully automatic operation. In either case the equipment required is simple, easy to operate and completely mobile.

For take-off, the U.10 is lined up on the runway, the master controller initiates the take-off signal, and a take-off controller holds it straight with a differential rudder facility without using optical sighting equipment. A pre-set pitch-attitude programme goes into operation when flying speed is reached. The master controller takes full control of the aircraft when he considers the moment has come to continue with the flight-plan.

For undercarriage operation the existing pilot's control switch is replaced by a three-position, Dowty-type push-button switch marked "Up," "Down" and "Auto." "Up" and "Down" are for manual operation by a check-pilot and override automatic operation. The usual ground safety and override to prevent or facilitate retraction on the ground are retained in the "Up" setting.

In the "Auto" position, the undercarriage is automatically operated through appropriate airspeed contacts. A speed-safety switch initiates retraction at 130 kt during take-off, after which the undercarriage remains locked up during the climb, slow and fast level, and fast glide fixed attitudes. When land glide is selected, it is automatically extended. The 130 kt setting used at take-off is replaced by a 160 kt setting for all other fixed attitudes.

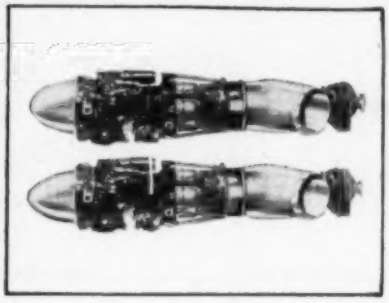
Similarly, the existing flap-control is replaced with a three-

(*continued at foot of page 912*)

Napier Elands power the Westland Westminster

The impressive performance of the Westland Westminster, seen for the first time at Farnborough 1958, is a tribute to the power of its Eland turbine engines.

The Military Crane version of the helicopter provides a transport of the first importance for the tactical movement of field equipment, atomic missiles and commando troops. The 46-seater civil version, with its twin-engine reliability, low noise level and freedom from vibration is an ideal helicopter for inter-city operation.



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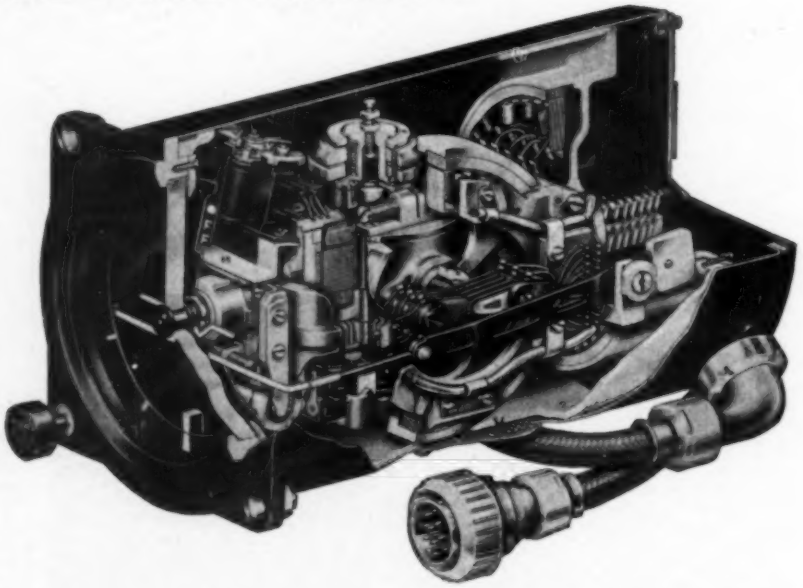

Following extensive trials, using photographic methods of recording errors, the performance of the Sperry H.L.7 (Mark 3D) Gyro Horizon in high-speed fighter aircraft has proved to be superior to that of any similar instrument subjected to this type of flight evaluation.

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Aircraft Electrical Systems

THE CASE FOR UNPARALLELED A.C.

By LIONEL G. HILL, D.F.H.

AT the symposium on aircraft electrical systems held at the I.E.E. in 1956 much of the discussion revolved around the relative merits of A.C. and D.C. It became obvious that in the aircraft industry there had arisen a "battle of the systems" which was—as I pointed out at the time—strangely reminiscent of the original battle of the systems fought out at the beginning of the century by such doughty champions as Dr. Ferranti and Col. Crompton. The results of that early struggle are now history, the doctor and A.C. winning hands down on distribution and general domestic and industrial appliances and the colonel and D.C. retaining honours in the fields of traction and heavy industrial applications involving variable-speed drives.

Today there is some indication that, on extra-high-voltage transmissions, there may still be a case for D.C., but there is general recognition that D.C. and A.C. each has its own specific fields of application. It is only by applying the right supply at the right place that fundamentally sound, stable and economic electrical installations can be devised.

Though today there is still the same diversity of opinions in the aircraft industry, on one point everyone is agreed. Electrical installations are consistently becoming far too complex and, with these complexities, more vulnerable to fault and instability and more difficult to service. No attempt to simplify them appears to be taking place. On the contrary, each new mark of existing systems includes additional features which have been introduced to compensate for fundamental weaknesses in the earlier marks.

There are, so far, four main systems in general or projected use in British aircraft: (1) 28V D.C.; (2) 112V D.C.; (3) rectified frequency-wild A.C.; and (4) constant-frequency A.C.

Of these four systems the 28V D.C. is in by far the largest number of aircraft and has a considerable background of operational experience. Power demands have increased to such an extent, however, that the supply voltage has now to be raised or the cable weight on heavy-duty services becomes disproportionately heavy. Logically the 112V D.C. system is the successor; and, in the opinion of many engineers (including myself) with D.C. and A.C. experience both in aircraft and industry, this is one which should be developed and which fundamentally promises the most for future aircraft. Unfortunately D.C. has got itself into hot water on two counts: brush-wear, and generator size per kilowatt output. Both of these are capable of solution but meanwhile the protagonists of A.C. have launched a two-pronged attack with rectified frequency-wild A.C. and paralleled constant-frequency A.C. systems.

The rectified A.C. group have made considerable headway in that these systems are currently in use in the Hermes, Comet, Ambassador, Victor and Britannia aircraft and are being developed for the Vanguard. This would appear to be a tactical, if not a major, victory for the group; but it is becoming evident from an examination of the latest layouts that they are getting more and more involved and vulnerable and are now hopelessly out of reach of the simplicity target.

The constant-frequency group has made some headway in the United States, where its methods were developed for military purposes and later applied to civil aircraft with varying degrees of success. In Great Britain the constant-frequency system has been applied to one of the V-bombers and is being currently considered in the project stage of long-distance civil jet aircraft. So far, however, in both countries together, the number of aircraft flying with constant-frequency systems is only a tiny proportion of the total number of aircraft in service, civil and military, and the operational experience to date can only be measured in months.

The constant-frequency group have loaded the dice against their system by plunging head-first into the deep end of system-development in endeavouring to start with a fully synchronized and paralleled system. This involves complexities of control which, expressed on paper, necessitates the provision of the following facilities: (a) close control of frequency; (b) synchronization; (c) real load sharing; and (d) reactive load sharing.

The gap between the expression on paper and the development in design is extremely wide and its translation to actual service conditions even wider. Not only have automatic or semi-automatic synchronizing systems to be developed and real and reactive load sharing loops to be devised, but protective circuits have had to be included to cater for the all too frequent occasion when alternators drop out of synchronism.

There is, of course, a fundamental difference between aircraft electrical generating systems and conventional power generating systems in that, in the aircraft, the alternator is an accessory to the main power unit, from which it absorbs something less than 5 per cent of the power output and which operates over a wide speed range, whereas in the conventional power station the turbine exists solely to drive the alternator, which absorbs some 95 per cent of the power output and is run at a closely controlled speed. Power station generators, once in synchronism, are virtually locked together electrically. Aircraft alternators are obviously powerless to hold in step the aircraft engines, though, by reason of the governors on the torque convertors and on the synchronized propeller control, they run at substantially the same speeds.

My personal opinions have already been expressed elsewhere on A.C. systems and it is not intended to repeat them here. If A.C. has any merits in distribution, it should first be tried out on an installation backed by a fundamentally simple and stable unparalleled generating system, dispensing with such refinements as synchronizing and real and reactive load sharing. Let us consider the case for the unparalleled system and how it may be devised.

[*Continued overleaf*

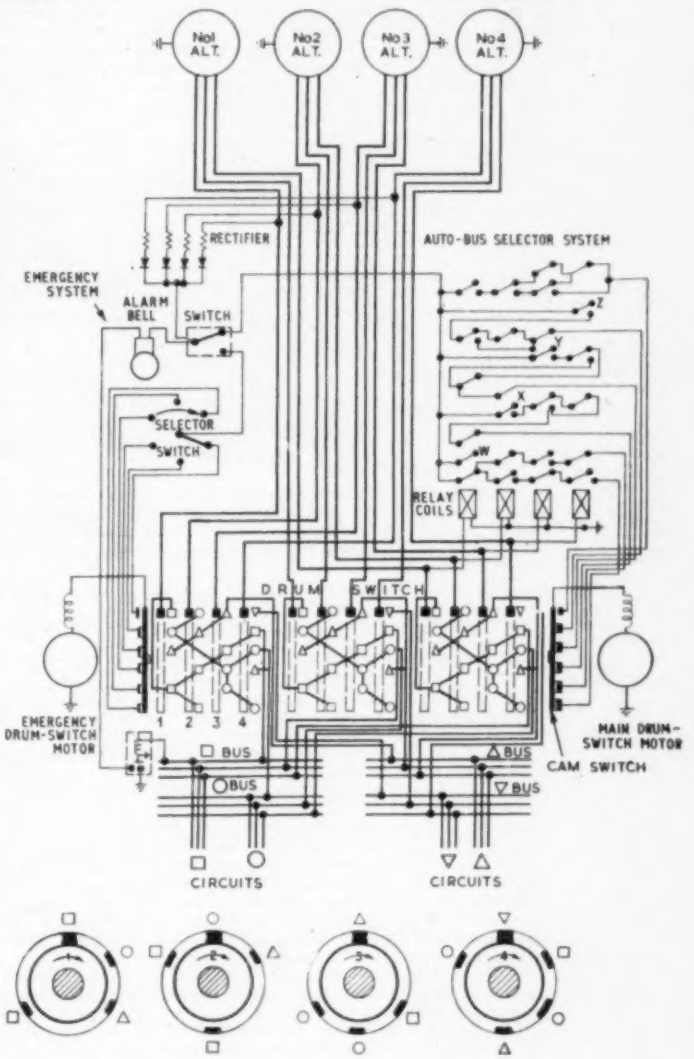

Fig. 1a (right, above) indicates the complete unparalleled system suggested. The drum-switches are seen end-on in Fig. 1b (right). In Fig. 1a they are opened out so that the 360-deg periphery is spread along vertical lines marked "1, 2, 3, 4," providing a plan-view of the external connections

AIRCRAFT ELECTRICAL SYSTEMS . . .

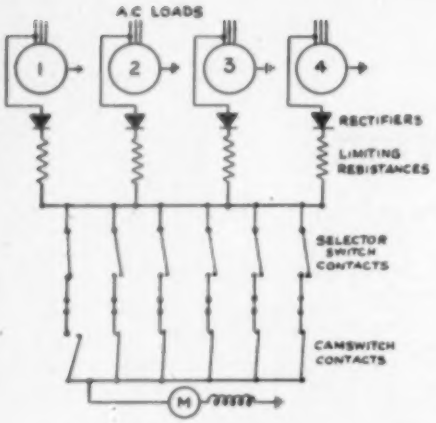

Fig. 2. Arrangement of the drum-switch control circuit

Requirements of the System. First we are faced with the problem of maintaining supply to essential services on all but a four-engine failure—we are, of course, considering a four-engine aircraft installation—irrespective of which engine or engines may fail. That is to say, each engine and its associated alternator must be capable of being connected, at an instant's notice, to the bus bar or bus bars which serve the vital circuits.

Let us suppose that we are designing such a system and that we have four 50 kVA 200/115V 400-cycle alternators, one on each engine supplying four three-phase, non-paralleled bus systems, and that we require fully automatic changeover to ensure that as long as any one engine is running a supply will be available from bus bars A, to which are connected the vital circuits. Furthermore, let us suppose that the remaining circuits, in order of importance, are connected to B and C with only non-essential services on D. The system is star-connected with the earth neutral return and we shall therefore require three bus bars, one per phase, for each alternator. [In our contributor's diagrams, for reasons of reproduction at practicable size, we have substituted symbols for these letters, as follows: A, □; B, ○; C, △; D, ▽. — Ed.]

The automatic changeover feature could be in the form of a drum-switch, motor driven, to effect the various interconnections between the bus bars. The contacts would have to be capable of carrying continuously $\frac{50 \times 1,000}{200 \times 1.73}$ or 144 amperes. All changeover operations must be completed within one second of the initiating impulse.

The arrangement of the fixed contacts on the drum switch to cater for every possible interconnection between alternators and bus bars within these requirements can be covered by six positions, as follows:—

Alternators	1	2	3	4
Position 1 to bus bars	□	○	△	▽
Position 2 to bus bars	○	△		□
Position 3 to bus bars	△		□	○
Position 4 to bus bars		□	○	△
Position 5 to bus bars	□		○	
Position 6 to bus bars		□		○

This arrangement allows for easy bridging of the contacts on the stationary member of the drum-switch and, by locating the moving contacts on the drum to traverse to any one of these six positions, all the following fifteen possible alternator failure conditions can be met:—

Gntrs. on	*Posn.*	*Gntrs. on*	*Posn.*	*Gntrs. on*	*Posn.*
1	1	1 and 3	5	1, 2 and 3	1
2	4	1 and 4	2	2, 3 and 4	4
3	3	2 and 3	4	1, 3 and 4	3
4	2	2 and 4	6	1, 2 and 4	2
1 and 2	1	3 and 4	3	1, 2, 3 and 4	1

The physical connections of such a switch are shown in Fig. 1b.

We must now arrange for the automatic changeover feature to operate on any possible combination of engine and/or alternator failure. We therefore drive the drum through its six positions by an electric motor having in its circuit a series of six parallel-connected contacts arranged around the drum-switch so that only one is opened by a cam or other suitable device at each of the six positions, and a further selector switch, also with six positions only one of which is closed at a time. Any movement of the selector switch will therefore automatically result in the motor driving the drum to the corresponding position, as seen in Fig 2. The drive from the motor to the drum could be a combination of gears and intermittent escapement which would provide a positive mechanical lock in each position and, at the same time, a smooth acceleration and retardation of the drum.

This first stage provides a form of manual selection. By replacing the selector switch contacts in the motor circuit with a group of contacts on relays, the coils of which are connected directly across the four alternators, an arrangement can be achieved in which the right selection of drum position is automatically effected by the conditions on the generating system itself. Such an arrangement is shown in the right-hand part of Fig 1a (auto-bus selector system).

Subsidiary matters have also to be decided. The motor drive is best derived from the paralleled output of rectifiers in each alternator output circuit. So long as any alternator is running there will be a supply available for driving the motor. With no engines running the drum-switch will remain stationary. To meet fault conditions arising out of the failure of any relay or the drum-switch operating motor, a second drum-switch motor could be incorporated, each motor driving the drum-switch in the same direction through a freewheeling device, operated from the pilot's panel by a manual selector switch adjacent to an emergency changeover toggle-switch which would transfer the supply from the main to the emergency motor. An alarm-bell circuit connected across the □ bus bar would give a single stroke each time the drum-switch operated and would ring continuously if supply was not immediately forthcoming to the essential services. The pilot would then only have to knock over the emergency toggle-switch and rotate the selector switch until the bell stopped ringing. A visual indicator of the conditions on the bus bars and alternators could also be included. The overall picture of the installation would thus appear as Fig. 1a and, provided that the original specified requirement of a maximum delay of one second for any change was achieved, the minimum period for a change between adjacent drum positions would be one-fifth of a second.

Advantages of Unparalleled A.C. Systems. The main advantage of the unparalleled A.C. aircraft system is, of course, that it dispenses with the two biggest technical problems in constant-frequency supplies, synchronization and sharing of both real and reactive loads. Each of these requirements on a fully paralleled system involves complex circuits, and experience to date on operational aircraft shows that, in the present state of development of constant frequency systems, the difficulties of maintaining a completely synchronized system are such that, although the necessary equipment is installed in the aircraft, all too often the system is operated in the unparalleled state for the larger part of its flying time.

This means that the aircraft is carrying a considerable weight penalty for electrical apparatus which is not being used. The fact that systems designed for parallel operations are consistently being operated in the unparalleled state without detriment to aircraft serviceability clearly establishes a case for the unparalleled system.

The sole disadvantage lies in the concentration of all main generator feeds in a single piece of equipment, the drum-switch, which therefore constitutes a vulnerable point in the whole electrical system. But this does not represent such a hazard as it may at first appear; provided that on starting up the same order of engine-starting is maintained, the number of times the drum-switch will be rotated is very small; and in all other aspects, recognizing the hazard, full allowance can be made both in electrical and mechanical design. If necessary an operation counter could be installed, with a servicing requirement after a prescribed number of operations. The drum-switch is, however, a time-established device of exceptional reliability under heavy and continuous duty. It is used extensively as a controller in traction work.

With the unparalleled system the switch and its associated relays could represent a total component weight of not more than 15-20 lb, far less than that of the synchronizing gear and four sets of load-sharing equipment on the paralleled system. Moreover, it would be possible to allow slightly more relaxation on frequency tolerances which must be much closer than would otherwise be essential for aircraft usage if synchronization between alternators is to be achieved. The relays themselves need only have relatively light contacts, since they are only called upon to "make" the circuit. The inductive break is taken by the much heavier cam-switch contacts. Another advantage is that, with the unparalleled system, alternator protection can be simplified. Main three-phase circuit-breakers, always a heavy item of equipment, can be dispensed with, the control being on the alternator field with primary A.C. line protection by H.R.C. fuses.

It may be that the airworthiness authorities or the airline operators insist that load-shedding shall not take place unless *two* of the alternators fail. This can be arranged by interposing a bus-coupling contactor between bus bars △ and ▽ which is automatically closed when any one of the alternators fails to generate. By paralleling the four spare contacts (W, X, Y, Z in Fig. 1a) and connecting them to the closing coil of the bus-coupler, not only will the failure of any one alternator energize the bus-coupler but, as soon as it backs on line, the bus bars will instantly be uncoupled.

Although no aircraft in current production or in the project stage is, so far as I am aware, planned for an unparalleled A.C. system, it has a strong case for consideration if only because, for once, it meets the requirements of simplicity. Its serviceability and stability in operation will be dependent only on the standard of manufacture of the components.

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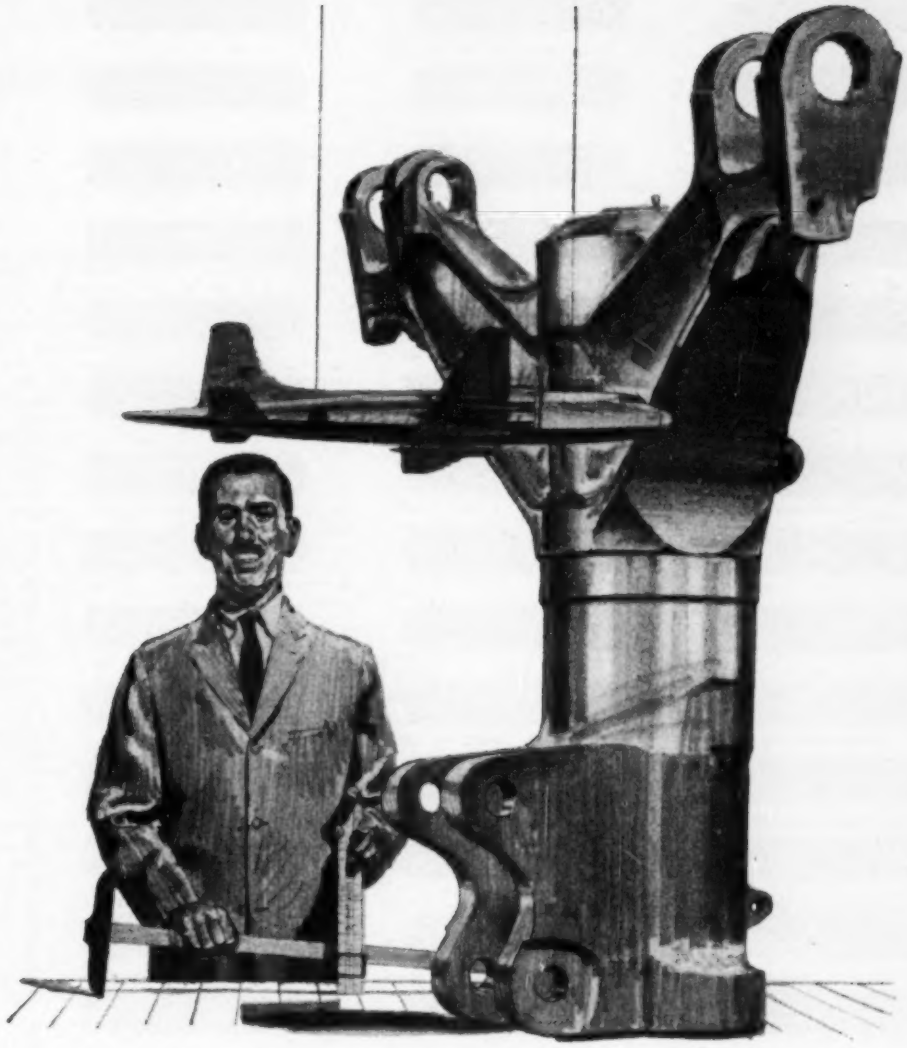

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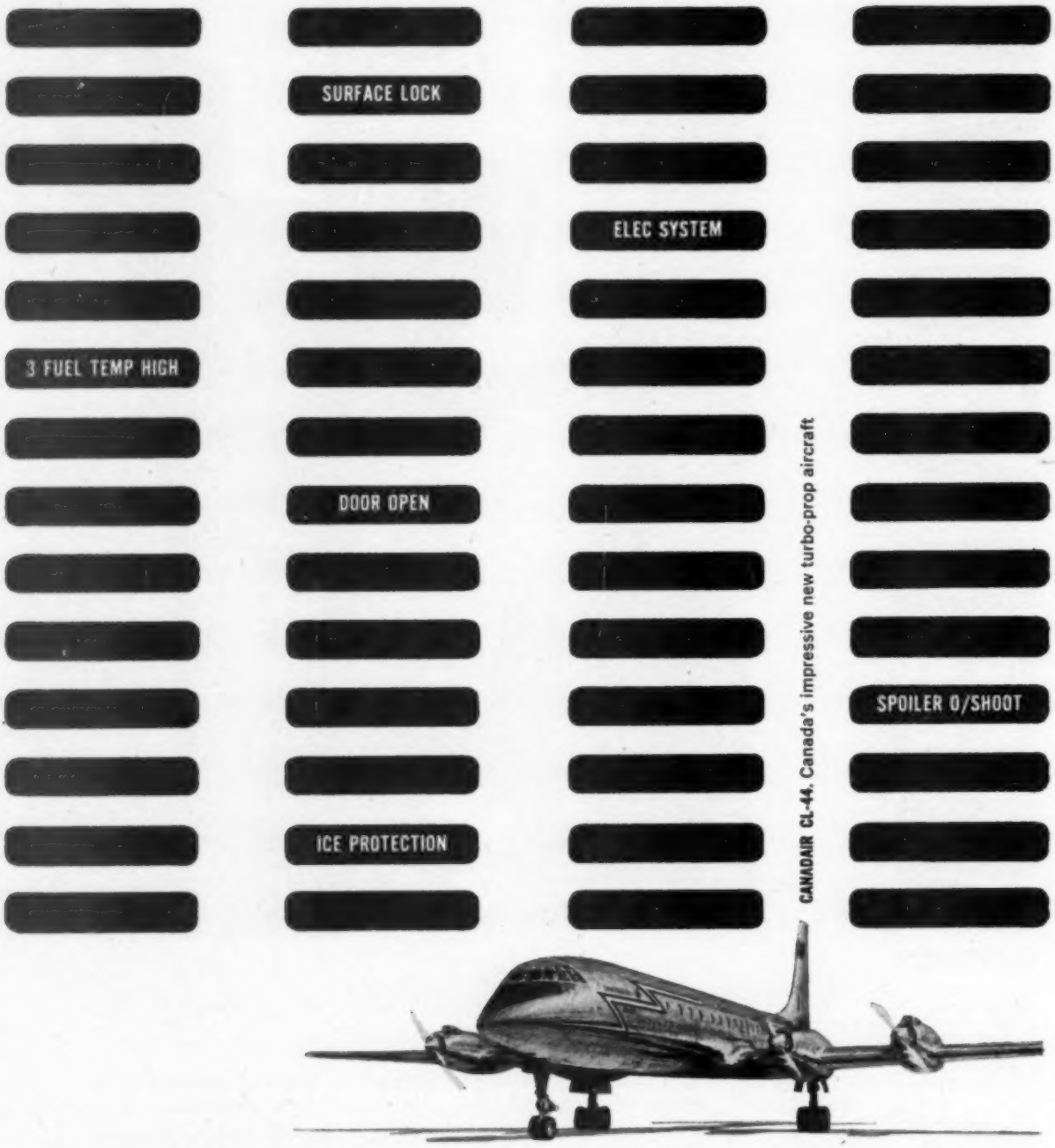

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Aircraft Development

— OVER 50 YEARS: THE SECOND CANTOR LECTURE OF THE R.S.A.

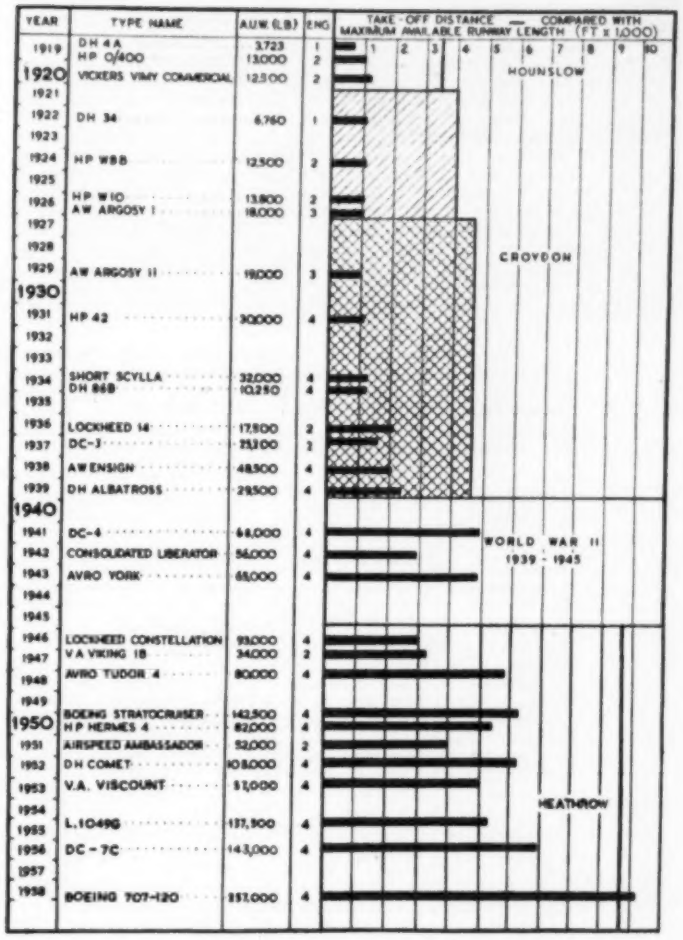
"THE entire development of the practical aeroplane has been concentrated within fifty years of the twentieth century. Created during the first eight years of the century, as a result of investigations and experiments made in the preceding hundred years, the aeroplane has evolved during the subsequent five decades into the most significant vehicle ever devised by man. Today, aircraft are still far from perfected and their evolution continues at headlong pace, but 1958 is perhaps an appropriate time at which to attempt to trace the pattern of their development."

This was the introduction to the second Cantor Lecture on the subject of the aeroplane, given before the Royal Society of Arts on December 1 by Peter W. Brooks, B.Sc.(Eng.), A.C.G.I., A.F.R.Ae.S., and titled *The Development of the Aeroplane*. The paper reviewed developments during the period 1908-1958 in the fields of aerodynamics, structures and powerplants. The interplay of the various conflicting factors is discussed; for example, Mr. Brooks notes that increases in lift coefficient "have done something to mitigate the effect of the astonishing growth in wing loading . . .", although he also points out that trends in minimum flying speeds have been less satisfactory, and have of necessity "been associated with remarkable changes in ground facilities."

During this 50-year period, Mr. Brooks said, a world total of more than £200 thousand million (in 1958 values) had been spent on aviation. It appeared that over 1½ million aeroplanes had been built, varying in value from light machines at a few hundred pounds to large jet bombers and transports each worth several million. The total comprised about 5,000 before 1914; nearly 200,000 during the 1914-18 war; about the same number between the wars; almost 700,000 during the 1939-45 war and "getting on towards half a million since." More than one-third of the total were built in the U.S.A.

Peter Brooks has lavished time and effort on this paper; it will undoubtedly be of immense value in putting a mighty picture into a perspective capable of assimilation in about an hour's reading. In fact, it might profitably be expanded into the most well-balanced semi-technical history of aircraft design yet attempted.

Below and on the following pages are three valuable tables—each obviously the end-product of many hours of labour—in which are outlined broad stages in the evolution of the aerodynamics, structures and powerplants of aeroplanes. In the original paper these are supplemented by numerous sketches of constructional



In the diagram above are plotted take-off requirements (bold horizontal lines) of transport aircraft which have operated into London. These are plotted against the run available at the contemporary London airport. The author leaves the reader to draw his own conclusion

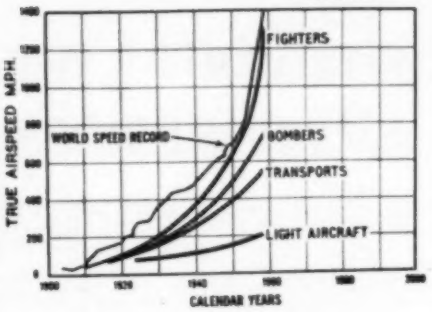
TABLE I: AERODYNAMICS

Period of ascendancy	Design configuration	Stability and control	Lift-controlling devices	Drag-controlling devices	Important refinements	Wing loading (lb/sq ft)	Wing thickness (per cent)	Speed range (m.p.h.) Min.	Speed range (m.p.h.) Max.
1903-1910	Tail-first biplane	Unstable as designed. Rear rudder, front elevator, wing warping.	None	Propeller	Wheeled undercarriage	1½-2	2	30	40
1907-1918	Boxkite biplane	Limited stability. Lifting tailplane. Rudder, front and/or rear elevator, side curtains or ailerons.	None	Propeller	Side curtains removed, nacelle accommodation, simplified tail unit with non-lifting tailplane, deletion of front elevator.	2-5	5-3	30 to 50	40 to 100
1908-1958 (continuing)	Braced monoplane	Stable. Lifting tailplane. Rudder, elevator, wing warping or ailerons.	Handley Page slots, flaps.	Propeller	Non-lifting tailplane, enclosed fuselage, faired undercarriage.	3-20	15-3	30 to 60	40 to 200
1910-1945	Tractor biplane	Stable. Lifting tailplane. Rudder, elevator, side curtains, wing warping or ailerons.	Handley Page slots, flaps.	Propeller	Non-lifting tailplane, enclosed fuselage, lateral and longitudinal dihedral and stagger for stability, wash-out, differential and Frise ailerons, "Eversharp" cowling, Townend ring, NACA cowling, faired undercarriage.	3-15	15-3	30 to 60	40 to 300
1915-1932	Thick-wing monoplane	Stable. Rudder, elevator, ailerons.	None	Propeller	Retractable undercarriage, Townend ring, NACA cowling, wing fillets.	15-20	20-15	50 to 60	100 to 170
1932-1958 (continuing)	Flapped monoplane	Stable. Rudder, elevator, ailerons.	Nose and trailing edge flaps, blown flaps.	Flaps, propeller and air brakes.	Improved wing sections, jet and turbo-prop power units.	15-125	15-3	40 to 125	100 to 1,500
1944-1958 (continuing)	Swept-wing monoplane	Stable (sometimes with artificial assistance). Rudder, elevator, ailerons/spoilers or elevons.	Nose and trailing edge flaps, blown flaps, lift-engines for STOL and VTOL	Flaps, air brakes and tail parachute.	Tail-less crescent and delta configurations, rocket propulsion, area rule.	50-125	8-3	100 to 125	500 to 1,500

AIRCRAFT DEVELOPMENT . . .

techniques and of complete aircraft of exceptional significance. The text which accompanied the tables and illustrations must have appeared an impossible challenge before it was written, but it is both succinct and readable. Although the author is careful not to moralize or condemn, it is hard to escape the inference that aeroplanes have not necessarily been getting safer—a suggestion which seems obvious from the diagram of take-off performance on the previous page. The paper includes a brief bibliography.

The first R.S.A. Cantor Lecture in this series, reported in *Flight* of November 28, was by C. H. Gibbs-Smith and was devoted to *The Birth of the Aeroplane*. The final lecture, *The Future of the Aeroplane*, was due to be given by Eric Mensforth on December 8.



This diagram traces the manner in which aeroplane speeds have increased during the past 50 years. The slope (and rate of change of slope) of each curve gives food for thought; he would be a bold prophet who would extrapolate them even for ten years hence

TABLE II: STRUCTURES

Period of ascendancy	Type of structure	Materials	Important refinements	Loaded weight (lb)	Originators of type of structure	Remarks
1903-1925	"Stick-and-string" biplane	Wood (spruce, ash, birch), steel fittings, fabric covering	Tractor layout. Plywood-covered fuselage. Mixed metal/wood construction	500-20,000	Wenham, Chanute, the Wrights	Triplanes and quadruplanes and limited popularity
1908-1958 (continuing)	Braced monoplane	Wood, metal or mixed wood/metal construction, fabric covering	Glass-fibre laminate covering	500-20,000	Cayley, Henson, Lilienthal, Blériot	Braced monoplanes are still common for light aircraft
1914-1945	Metal/fabric biplane	Light alloy or steel structure, fabric covering	Metal monocoque fuselage. Alclad	1,000-30,000	Breguet, Short	Notably British designs, 1925-35
1917-1945	Metal monoplane (skin not fully load-bearing)	Steel or light alloy main structure, light alloy (often corrugated) covering	Smooth skin	1,000-30,000	Junkers, Dornier, Rohrbach	Notably Junkers and Ford, cantilever, and Dornier, usually braced, designs. Rohrbach braced for torsion only
1918-1945	Stressed-skin wooden monoplane	Wooden wing with plywood covering. Steel tube fuselage, fabric covering	Wood monocoque or metal monocoque fuselage	1,000-30,000	Fokker, Lockheed	Notably Fokker designs. All-wood stressed skin designs are still common for light aircraft
1928-1945	Metal/fabric monoplane	Light alloy or steel structure, fabric covering	Metal stressed-skin wings. Alclad. Elimination of flutter aerodynamically and by mass-balancing	1,000-60,000	Langley, Esnault-Pelterie, Dewoitine	Notably Steiger Monospar and Wallis Geodetic designs
1928-1958 (continuing)	Stressed-skin metal monoplane	Built up of riveted light alloy sheet, pressings and extrusions	Integrally machined light alloy members. Plastic bonding and foam fillings. Fibre-glass laminates, steel and titanium	2,000-400,000	Junkers, Rohrbach, Short, Northrop	Rohrbach designs in the 1920s leading to American development in the 1930s

TABLE III: POWERPLANTS

Period of ascendancy	Piston engine or gas turbine	Engine type		Important developments	Maximum power	Weight (lb/h.p.)	Specific fuel consumption (lb/h.p. hr)	Remarks
1903-1920	Piston engines	Water-cooled	In-line	Dual ignition. Gearing	15-300 h.p.	13-2.5	0.6-0.5	Originally derived from car engines.
1905-1930			Vee	Gearing. Sleeve valves. Broad-arrow and H configurations. Supercharging. Variable-pitch and constant speed propellers. Higher-duty fuels. Fuel injection	25-3,500 h.p.	7-1	0.6-0.4	Vees and broad arrows, upright and inverted
1908-1925		Air-cooled	Rotary	Monosoupape	30-240 h.p.	4-2	0.7-0.6	
1909-1958 (continuing)			Radial	Gearing. Sleeve valves. Supercharging and compounding. Variable pitch and constant speed propellers. Higher-duty fuels. Fuel injection	20-3,500 h.p.	8-0.9	0.5-0.4	Single and multi-row
1911-1958 (continuing)			Horizontally opposed	Gearing. Supercharging. Variable-pitch and constant speed propellers. Higher-duty fuels	5-500 h.p.	6-1	0.7-0.4	Most common type of light aircraft engine today
1913-1918			Vee	Gearing. Supercharging. Variable-pitch and constand speed propellers. Higher-duty fuels	70-500 h.p.	6-1.5	0.7-0.5	Upright and inverted. Brief revival in 1930s
1925-1958 (continuing)			In-line		50-350 h.p.	4-2	0.6-0.5	Upright and inverted. Most common type of light aircraft engine engine before 1939
1944-1958 (continuing)	Gas turbines	Centrifugal compressor	Turbojet	Water/methanol injection. Afterburning. Twin-spool. Bypass. Ducted fan. "Exotic" fuels for boosting	200-2,500 h.p.* (500-6,000 lb. s.t.)	2.0-0.3*	5-2.5*	Obsolescent today except in smallest sizes
1944-1958 (continuing)		Axial compressor			400-7,000 h.p.* (1,000-18,000 lb s.t.)	2.5-0.2*	2.5-2*	
1953-1958 (continuing)		Centrifugal compressor	Turboprop	Water/methanol injection. Free power turbine. Twin-spool	400-2,000 h.p.	1.3-0.6*	1.0-0.5	Combined axial and centrifugal compressors
1955-1958 (continuing)		Axial compressor			1,000-12,000 h.p.	0.8-0.3*	0.7-0.4	

*Based on the assumption that 2.5 lb thrust = 1 h.p.

AIR SURVEY IN FRANCE

Its Development and Present Status

THE highly specialized technique of air survey has developed along various lines in different parts of the world. With its strong implications in military matters and in questions of land ownership, survey for mapping purposes has often been the prerogative of the State or has been controlled by it; and the adaptation of aircraft and airborne techniques has therefore also developed on a national or regional basis.

This has certainly been the case in France where, by World War 1, a long tradition of photogrammetric mapping had existed since Colonel Laussedat, "the father of photogrammetry," had begun his work in about 1850. It was in this tradition that French technicians in 1919 tackled the difficult problem of developing plotting machinery to make use of aerial photographs. They were already aware of the tremendous advantage to be gained by the use of aircraft, and several plotting machines were soon developed. Of these, the stereotopograph produced by Poivilliers-S.O.M. was to be adopted on a considerable scale and developed to a very high degree. From 1935 onwards, and more especially after 1945, the Société d'Optique et de Méchanique de Haute Précision at Paris constructed and delivered throughout the world about 150 of these machines. The design was continually developed and improved to keep pace with the evolution of modern techniques. At present, ninety stereotopographs of first-order accuracy (Type B) and sixty of second-order (Type D) are in service with both official and private survey companies, notably in France, Belgium, Yugoslavia, Syria, Lebanon, Persia, Morocco, Tunisia, Uruguay, and Argentina. Few companies have a longer production record.

Plotting can give the best results only if the original photograph has been taken with appropriate and highly accurate equipment. It was for this reason that the French manufacturers developed specialized cameras in parallel with the plotting machinery. From 1934 onwards, while other companies were using batteries of cameras in order to increase the field of view, the French decided on the use of a single wide-angle lens, a method which has since been generally accepted. Investigation of the problems led the S.O.M. company to produce a whole range of lenses of wider and wider angle, one of the latest of which is the Aquilor, with its focal length of 125 mm, 19×19 cm format and viewing angle of 90 deg. This lens can be made in large numbers while maintaining remarkably constant optical characteristics—an important asset for precision plotting. It is hardly advisable at present to exceed the 90-deg angle, because various factors, including that of atmospheric refraction, can subsequently cause a loss of precision.

S.O.M. has produced several hundred cameras of all types, with long and short focal lengths, using plate or film and different formats. It was one of the first, and still remains one of the few companies in the world, which can now offer a fully-automatic plate camera equipped with a wide-angle lens. This machine carries a magazine of 96 plates measuring 19×19 cm and has a lens of 125 mm focal length. French operators, in fact, consider that only the plate can provide a base for photographic emulsion sufficiently stable to satisfy the precision requirements of mapping photography.

"Flight" photograph

One of a number of Hurel-Dubois HD.34 survey aircraft operated by the Institut Géographique National. Powered by two Wright R-1820s giving 1,520 h.p. each, the HD.34 can cruise for eight hours at 15,000ft some 500 miles from its base with a photographic load of 5,700 lb. Plate magazines are loaded and handled by an overhead gantry system. The nosewheel only is retractable

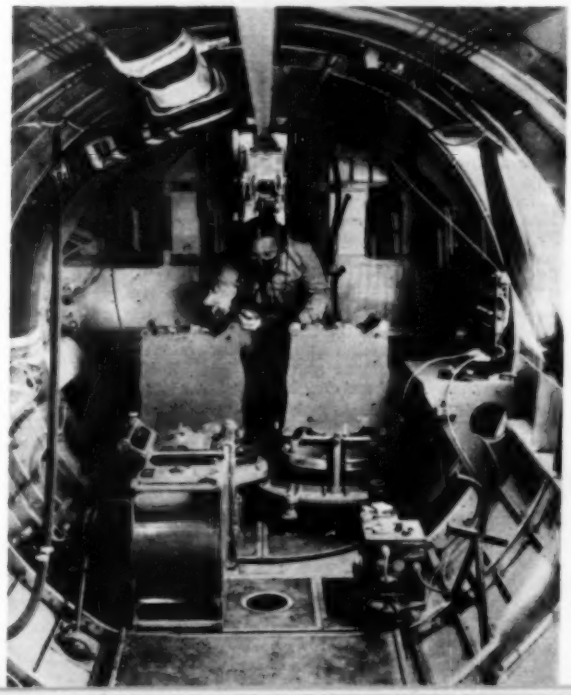
Operational techniques developed in step with the equipment. The French army survey service had, in 1920, the task of preparing up-to-date maps of metropolitan France and North Africa respectively at scales of 1:20,000 and 1:50,000. It therefore greatly encouraged the efforts of the research workers and, as soon as the first plotting machines appeared, strongly supported the introduction of photogrammetric methods. In 1940 the organization was re-named the Institut Géographique National and in 1943 it was charged with the preparation of new maps of the whole French Union. Since then it has systematically increased its capacity and productivity and has consequently become one of the most important photogrammetric map-making organizations in the world and works on an industrial basis.

Because it had early been understood that the precision and the information derived from a photogrammetric map depended in the first place on the quality and regularity of the photographic cover, the military survey service formed a specialized air-survey squadron in 1938. There are now no fewer than four such squadrons formed into a group of the Institut Géographique National. They are equipped with about fifteen Boeing B-17 and Hurel-Dubois HD.34 aircraft and about a hundred cameras of various types. Their mission is still to provide a systematic and complete photographic coverage of all the territories in the French Union and, in addition, to fulfil requests for special coverage in any scale from agencies all over the world.

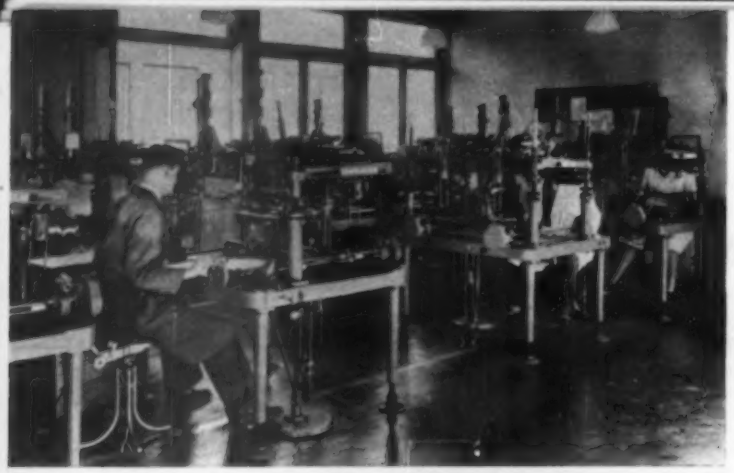
The area photographed by the group in recent years has varied between 1,500,000 and 2,000,000 sq km for maps at scales between 1:5,000 and 1:80,000. Between 1952 and 1955 the four French photographic squadrons alone accounted for 45 per cent of all the areas photographed throughout the world. Outside the French Union the group carried out photography for large-scale maps of Luxembourg and the Saar and completed other assignments in Germany, Austria, Lebanon and elsewhere. Because the crews are specialized and highly trained they achieve exceptionally exact navigation using methods specially developed for this purpose.

The Institut Géographique National has from the beginning concentrated on producing a method of plotting which can be applied by unskilled operators without special technical training. Their only *a priori* qualification is that they should have good stereoscopic vision. About 115 first- and second-order plotting machines are now being used by these operators in several sections specializing in large-, medium- and small-scale work. These sections together produced maps of 180,000 sq km of ground during 1957 at scales between 1:20,000 and 1:100,000, as well as some special work at larger scales. The employment of relatively unskilled personnel keeps costs down while quality is still maintained at the highest level by careful checking and control at every stage of production.

During the last fifteen years the Institut Géographique National has carefully studied simple methods of aerotriangulation, the process required to establish dimensionally accurate networks of check points on which the plotting of topographic features can be



French operator supervises vertical survey cameras mounted in the former ball turret location in a Boeing B-17



Some of the 115 plotting machines of various types operated by the Institut Géographique National in Paris

AIR SURVEY IN FRANCE . . .

based. This is particularly important when preparing maps of regions which are particularly inhospitable to the ground teams who are often relied upon to prepare the initial triangulation. French territories in tropical and equatorial Africa, moreover, rely on the rapid production of accurate maps for their effective future development. Since 1950 these methods have been systematically applied and constitute the normal French procedure in triangulation. Organizations in other parts of the world still largely prepare triangulation on the ground and have only applied aerotriangulation on a sporadic or experimental basis.

The quality and effectiveness of French equipment and methods, both in aerotriangulation and in plotting, were proved by the controlled tests organized by the International Photogrammetric Society, the results of which were published during that Society's congress in Stockholm in 1956. All the results obtained by the Institut Géographique National were shown to be at least equal to, if not better in precision and detail than, those produced by other organizations.

These results can be mainly attributed to the highly centralized organization of the Institut by which all the very different special phases in the production of a map—aerial photography, work on the ground, aerotriangulation and plotting, editing and printing of maps—are combined in a single establishment. Their work is closely co-ordinated to produce an effective end product and all improvements can be aimed solely at raising the quality of the maps produced.

It is also noteworthy that in France other official agencies like the Cadastral Service and the survey department of the Ministry of Reconstruction and Housing both habitually employ photogrammetric facilities for land-ownership and town surveys. They have developed their own methods and equipment to handle their particular problems. In addition, a number of private companies possess first- and second-order plotting machines which can take care of work which does not fall within the province of the official map-making organizations.

PROFILE OF THE INDUSTRY

AT first glance the recently published *Census of Production** for 1957 suggests that the British aircraft industry is proving to be a fertile field for the application of Parkinson's Law. Last year's Board of Trade figures show that although total employment fell, and output started to slacken, the number of "other employees"—and this is more or less equivalent to "white-collar workers"—continued to rise. Another manifestation of Parkinson's Law is that the remuneration of these "other employees" increased four times more rapidly than did their total employment. Even more remarkable is the fact that salaries and wages paid to "operatives" increased by 1 per cent while their number fell by 3 per cent.

Year	Gross output	Net output	Average number employed			Wages and salaries		Change during the year in		Capital expenditure	
			Total, including working proprietors	Operatives	Other employees	Operatives	Other employees	Stocks of materials and fuel	Work in progress and stocks of finished products	Plant machinery and vehicles acquired	New building work
	£ million		Thousands			£ million					
1954	394.5	195.6	241.8	165.1	76.6	87.3	43.8	−3.6	+34.1	8.3	3.7
1955	436.4	232.5	256.8	171.6	85.2	96.9	53.1	+6.3	+17.5	10.4	4.9
1956	529.0	263.1	271.2	176.3	95.0	108.6	63.1	+5.4	+54.9	14.9	6.3
1957	559.6	269.1	269.6	171.9	97.8	109.6	70.0	+2.3	+39.8	13.1	5.3

In both the American and British aircraft industries, for every two blue-collar workers there is one white-collar worker. In both countries the proportion of non-production staff has been increasing steadily year by year, with Britain always in the lead.

The gross output of the U.K. industry continued to rise, and last year reached £560m. But this figure, which represents the total value of all goods produced by every company, includes what the Board of Trade politely describe as "an element of duplication." To reach a figure representative of "the value added to materials by the process of production," the Board deducts from gross output the amounts paid for materials, fuel and transport, together with the value of all subcontracted items, the balance being described as "net output." This was valued last year at £269m, a 2 per cent gain on 1957 and probably the industry's peak figure for some time to come. To put the aircraft industry into perspective, the value of its output is rather more than that of the radio and electronics industry and rather less than that of the clothing business.

Despite a slow rise in the value of output, the other financial items point towards a decline in aircraft production. Although stocks of materials and fuel continued to rise, the rate of growth is tailing off. Similarly, the value of capital expenditure fell in 1957 for the first time since 1954.

**Summarized in the "Board of Trade Journal" for November 21.*

CANBERRA FOR MISSILE TRIALS (continued from page 906)

position toggle switch (with appropriately shaped knob) marked "Up," "Auto" and "Down." "Up" and "Down" here also correspond to the existing manually-selected settings and override "Auto." In "Auto," the flaps are automatically extended when land glide attitude is selected. The speed safety switch and an interlock circuit lock the flaps up at speeds of over 160 kt, and in all attitudes other than land glide and overshoot. An override command allows the ground controller to prevent the flaps extending during a single-engined approach and landing.

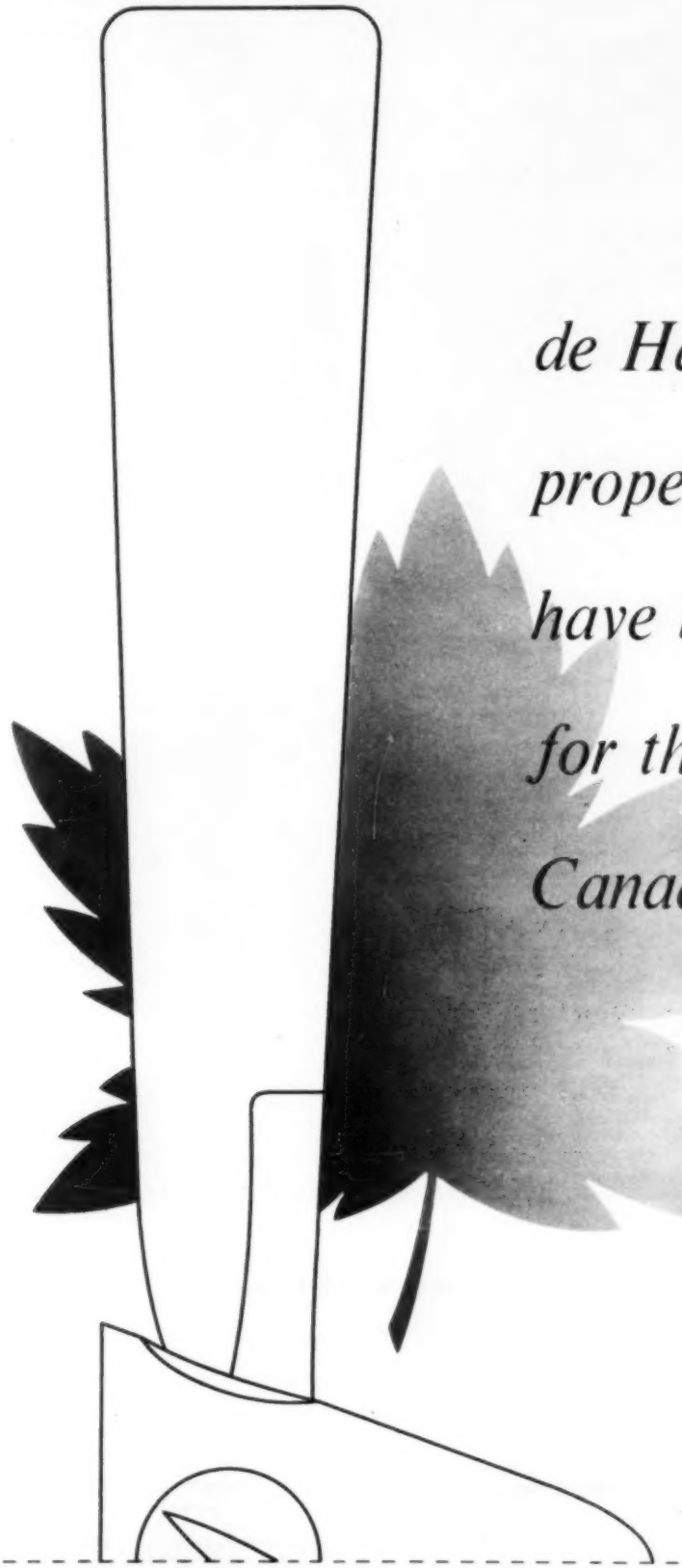
Air-brake control is also arranged for "Out," "In" and "Auto" and the first two again override the "Auto." In "Auto," the air-brakes are automatically selected from the airspeed-control system so that, in the fast and slow level attitudes, they extend if the actual airspeed exceeds that demanded. In fast glide (above 2,000ft) the air-brakes are extended when the datum speed is reached, and also during transition to slow level until the actual airspeed falls for the first time to that demanded. In climb, glide below 2,000ft (land glide) and overshoot the brakes stay in.

Automatic control of the wheel-brakes is selected by a master switch in the cockpit. Before take-off, pressure is admitted to the brakes via a solenoid valve which is de-energized to release the brakes just after full power is attained. The brakes are again momentarily applied to stop the wheels spinning immediately before retraction of the undercarriage.

Brake pressure is re-admitted to the brake system via the solenoid valve when land glide is selected, but the anti-skid device prevents the brakes being applied until after wheel spin-up following touch-down. After touch-down, differential brake is automatically applied through the rudder channel. When a human pilot is on board the brakes can be normally operated. In order to stop the aircraft again in the event of a baulked take-off, the brakes are automatically applied on the command "Fuel off."

A braking parachute is automatically streamed after touch-down, but only when land glide has been selected. The 'chute may be normally streamed and jettisoned by a human pilot should he require its assistance.

The Canberra U.10 is fitted with equipment which automatically records missile miss-distances for subsequent analysis. The system was developed by Shorts in collaboration with the Weapon Research Establishment in South Australia. Timing sequences to operate the equipment in co-ordination with missile firings are initiated from the ground.



D/H PROPELLERS

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have been selected

for the

Canadair CL. 44

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An impression by John Stobart of an R.C.A.F. CL-44 (known to the Service, who have ordered eight, as the CC-106) at Dorval

CANADAIR CL-44

"FLEXIBILITY and economics of a wholly outstanding order" was the phrase used of the Tyne-powered Canadair CL-44D design in *Flight's* review of the world's commercial aircraft on July 25 this year. Although the first machine of this type—the first of eight CC-106 transports for the R.C.A.F.—is not expected to fly before next October, the design and construction of the basic machine and the interior layout of the civil CL-44D are of particular interest at the present time. Capable of carrying up to 167 passengers, the Canadair Liner, as it is known, promises real economy plus long range.

To date, Canadian Pacific Air Lines have expressed an interest in the CL-44 (and have been quoted a November 1960 delivery date by Canadair) and a number of other international airlines are also keeping an eye on the machine's capabilities. But the future commercial prospects of any long-range turboprop transport must depend on the answer to the question of the airline fare differential. If a two-level fare structure were generally accepted by the world's airlines, the CL-44 could open up a vast new market in low-cost air transport. It will have a lower direct operating cost, the company state, than any other aircraft on offer to the airlines.

The CL-44's Britannia ancestry is well known, and may be said to have begun with the design and manufacture by the Montreal company of the CL-28 maritime reconnaissance aircraft, an unpressurized derivative of the Britannia powered by four Wright Turbo-Compound engines (*Flight*, October 4, 1957). The CL-44 was originally planned as a "stretched" Britannia powered by Bristol Orions, and when development of this engine ceased a switch was made to the Rolls-Royce Tyne—without postponing the first-flight date.

In most respects the construction of the CL-44 airframe follows Britannia practice. As in the case of the CL-28, however, numerous changes in systems, materials, accessories and equipment have been made in conformity with North American practice and to meet customer requirements.

These changes include the adoption of a 3,000 lb/sq in hydraulic system, mechanically-driven blowers for cabin pressurization, a new electrical system, and an auxiliary power unit based on a Blackburn-Turboméca Artouste gas turbine. In addition the wing structure has been revised to provide integral tankage for a greatly increased volume of fuel.

AIRFRAME STRUCTURE. The wing group consists of a primary structure, leading edges, wingtips, ailerons, servo-tabs flaps, spoilers, compartments within the box spar for flexible fuel cells and integral tanks and stowage for four life rafts.

With the exception of the main underskin, of 24ST aluminium-alloy clad sheet, the wing structure is of 75ST. The uniformly tapered box spar comprises upper and lower skins stiffened by close-pitched spanwise stringers, vertical shear webs at 15 and 50 per cent chord, and chordwise ribs. The sectioned leading-edge structure carries a hot-air duct for thermal anti-icing.

Double-slotted flaps and ailerons are similar to those of the Britannia, and at speeds up to 200 kt aileron action is assisted by spanwise spoilers, located as on the CL-28 along the upper surface between ailerons and outer nacelles. For emergency descent the landing gear may be lowered as a speed-brake.

Compared with that of the Britannia, the tail assembly employs hot-air ducts (in place of electric mats) for fin and tail-plane anti-icing, and the upper part of the fin is isolated by a structural dielectric insert to form a fin cap aerial.

The fuselage is constructed of 24ST skinning riveted to continuous 75ST longitudinal stringers and frames, with local reinforcement by longerons, bonded skin lamination or riveted plates where necessary. Apart from the increased cabin length, a major difference from the Britannia lies in the provision of two large power-operated cargo doors, which hinge at the top and open outwards, on the port side of the fuselage. The forward door measures 75in high × 93in wide and incorporates a 60in × 28½in crew entrance door; and the rear door, including the 64in × 36in passenger entrance door, has a clear opening of 78in × 120in. There are three underfloor baggage doors on the starboard side, each measuring 26in × 54in.

INTERIOR. As illustrated in the cutaway drawing, the interior layout of the CL-44 incorporates (a) faired, unpressurized nose section, (b) crew compartment, (c) main passenger cabin with 167 seats, toilets, washrooms and galley, (d) unpressurized tail section, (e) two pressurized underfloor baggage holds, and (f) various equipment compartments.

The crew compartment has stations for pilot, co-pilot, flight engineer (or "systems operator") and navigator, and also a galley and toilet. A cabin crew of three is envisaged, whose folding seats are at the rear (2) and front (1) of the main passenger cabin.

LANDING GEAR. The fully retractable undercarriage is of basic British Messier design, re-engineered by Canadair and manufactured under subcontract by Jarry Hydraulics, Montreal. Each main gear comprises a bogie carrying two pairs of wheels in tandem pivoted to an oleo-pneumatic shock strut hinged at its upper end to the wing box spar and braced by a forward telescopically extending drag strut. Retraction (backwards into the inner nacelles), extension and locking of the main gear is a combined hydraulic/mechanical operation.

The steerable twin-wheel nose gear incorporates an oleo-pneumatic shock-strut (swung from a cross-beam in the fuselage nose) which is braced laterally by struts, with fore-and-aft loads being transmitted by a folding drag strut. Retraction (forwards) and extension is hydraulic, and the uplock and downlock engage mechanically and are released hydraulically.

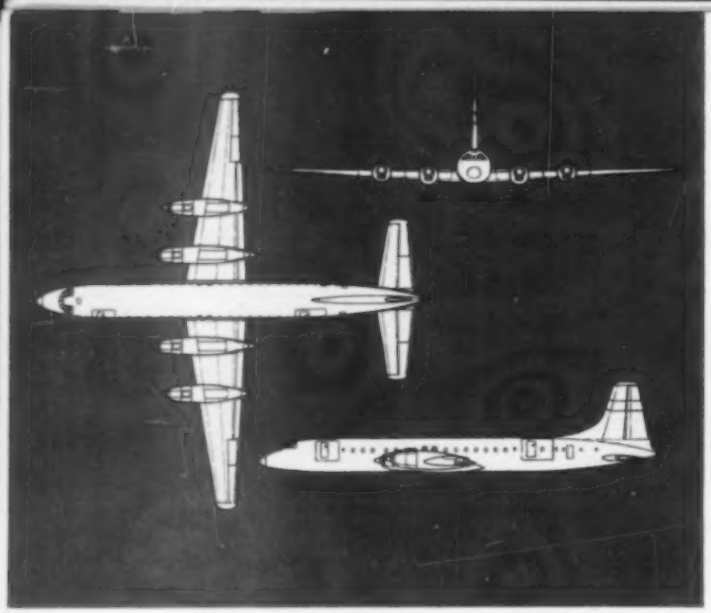
POWERPLANT. The aircraft is powered by four Rolls-Royce Tyne 12 515/10 twin-spool axial turboprops of 5,730 e.h.p. each, driving 16ft diameter, four-bladed de Havilland Hydromatic 4/7000/6 reversible propellers. Directly mounted engine-driven accessories include Lucas main fuel pump, starter, and h-p. and l-p. governor; Plessey fuel backing pump; Rotol propeller synchrophasing alternator; and D.H. propeller controller and feathering pumps. A remotely mounted gearbox, driven by a shaft from the l-p. compressor, carries Sundstrand constant-speed drives, Westinghouse A.C. generators, Vickers hydraulic pumps and Godfrey cabin superchargers.

A main annular air intake and an auxiliary scoop top and bottom are incorporated, the auxiliary intakes providing air for cabin pressurization, wing anti-icing and ventilation and cooling air for engine oil coolers and accessories. The exhaust system is designed to utilize residual thrust and consists of a "plug-in" engine exhaust pipe with an upswept tailpipe.

The fuel system employs two port and two starboard main tanks (inboard 1,910 Imp. gal each; outboard, 1,887 gal each); port and starboard outboard auxiliary tanks (458 gal each) and a centre-section auxiliary tank of 1,640 gal. With the exception of the centre-section tank, made up of six flexible fuel cells, all tanks are of integral construction. Total usable fuel capacity is 10,150 Imp. gal, compared with 8,580 in the Britannia 320.

AUXILIARY POWER UNIT. The Blackburn-Turboméca Artouste 511/001 auxiliary power unit provides compressed air for low-pressure air starting of the main engines and for cabin conditioning, electrical power for ground servicing, and hydraulic

(Continued on page 916, after cut-away drawing of CL-44)



CANADAIR CL-44D

Four Rolls-Royce Tyne 12 turboprops of 5,730 e.h.p. each

Dimensions: Span, 142ft 3½in; length, 136ft 8in; height, 38ft 7in; wing area, 2,075 sq ft; aerofoil section, root, NACA 23017; tip, NACA 4413 modified; aspect ratio, 9.76; dihedral, 3 deg; total flap area, 410 sq ft; aileron area (each), 70.2 sq ft; tailplane span, 54ft 8in; tailplane area, 586 sq ft; elevator area (each), 85 sq ft; fin and rudder area, 356.4 sq ft; rudder area, 92.2 sq ft; outside fuselage diameter, 12ft; undercarriage track, 31ft; wheelbase, 48ft 3½in; cabin dimensions, see Payload Accommodation section of text.

Weights: Maximum take-off weight, 205,000 lb; maximum landing weight, 160,000 lb; maximum zero-fuel weight, 155,000 lb; operating weight empty (passenger, international), 104,388 lb; (cargo, international), 92,606 lb.

Performance: C.A.R. take-off field length (at 205,000 lb), 7,600ft; time to 15,000ft (at 205,000 lb), 22½ min; time to 20,000ft (at 180,000 lb), 24 min; cruising speed at 20,000ft (at 170,000 lb), 340 kt; C.A.R. landing field length (at 160,000 lb), 6,200ft; payload-range characteristics (international), see graph; (domestic), maximum cargo payload, 65,780 lb; range with this payload (½ hr fuel reserve), 3,000 n.miles.

Engine Performance: Take-off (sea-level), 15,250 r.p.m.; 5,300 s.h.p.; 5,730 e.h.p.; 0.463 lb/e.h.p./hr specific fuel consumption; maximum continuous (sea-level), 14,100 r.p.m.; 4,620 s.h.p.; 4,975 e.h.p.; 0.464 lb/e.h.p./hr; cruising at 320 kt T.A.S. (25,000ft), 13,500 r.p.m.; 2,780 s.h.p.; 3,033 e.h.p.; 0.398 lb/e.h.p./hr.

CANADAIR CL-44 . . .

1 Hinged die
2 Artouste a
3 a.p.u. exhe
4 a.p.u. deliv
5 a.p.u. vent
6 a.p.u. Firex
7 Front pres
8 Pre-closing
9 Nosewheel
10 Laminated windscreen
11 Tubeless ty turning cir
12 Systems op
13 Navigator
14 Radio rack
15 Main electr
16 Junction bo
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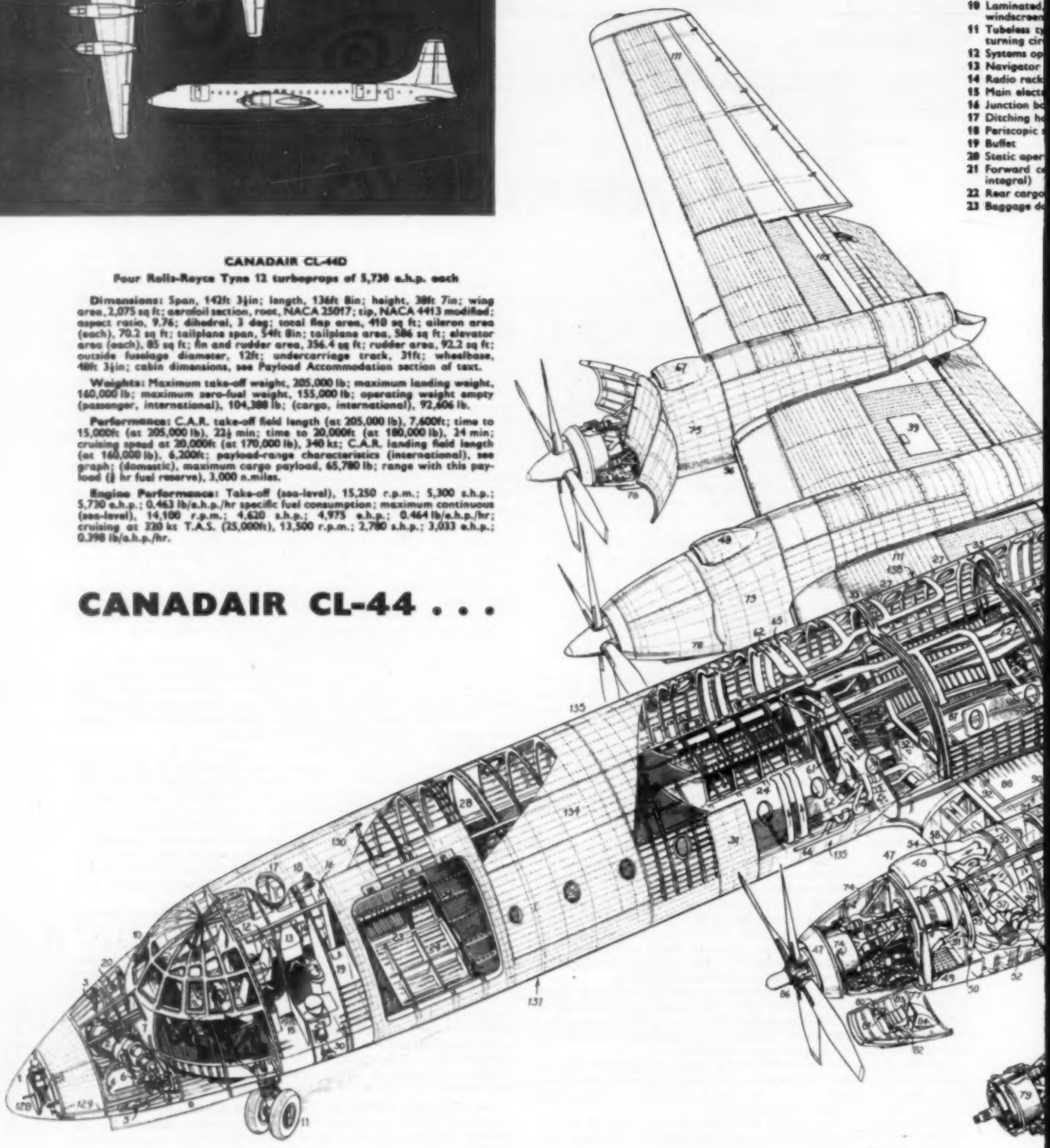
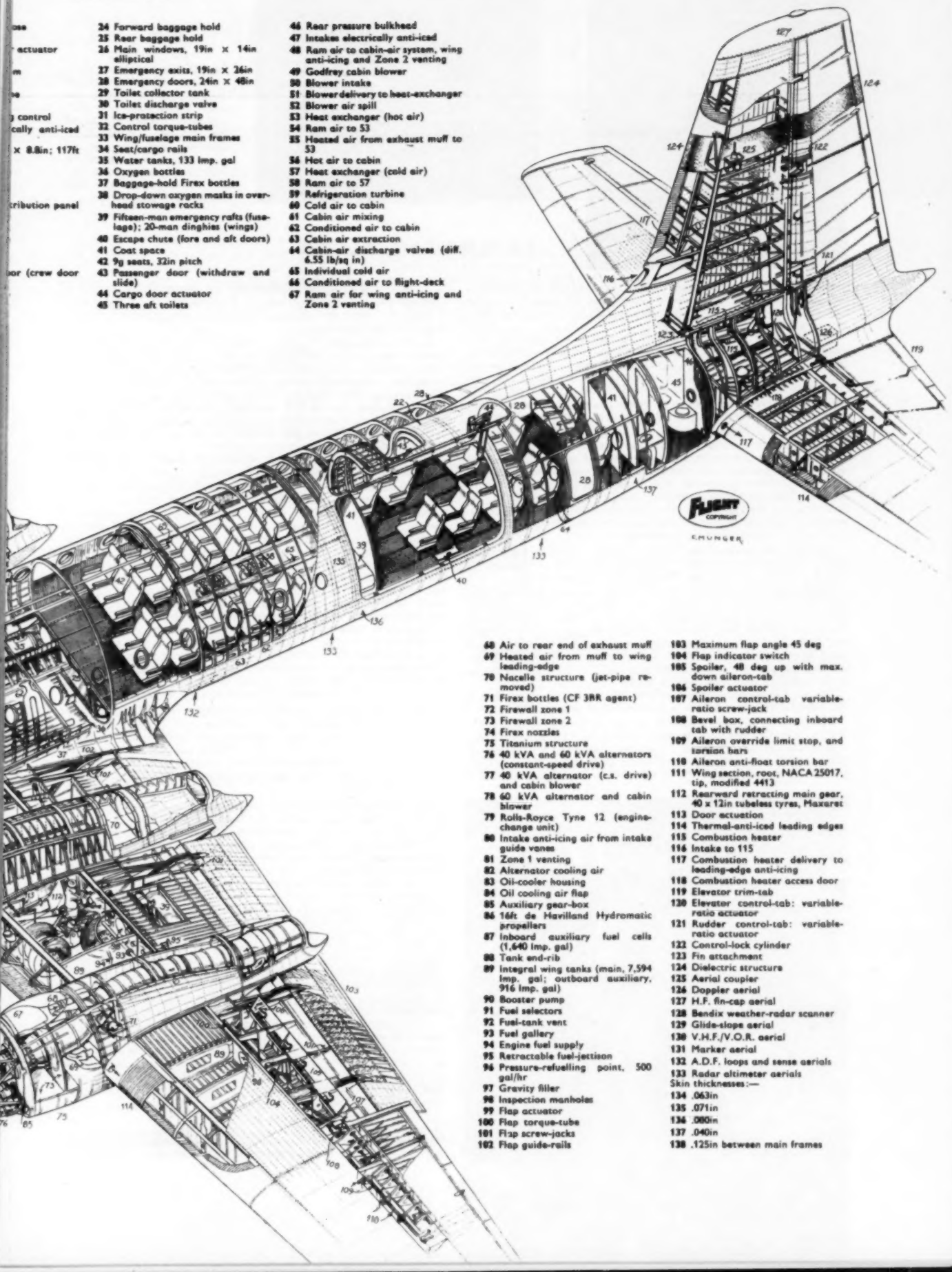
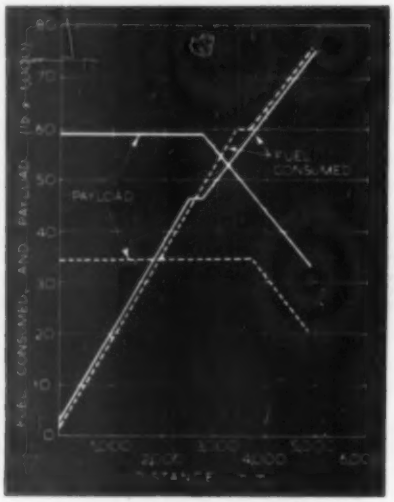
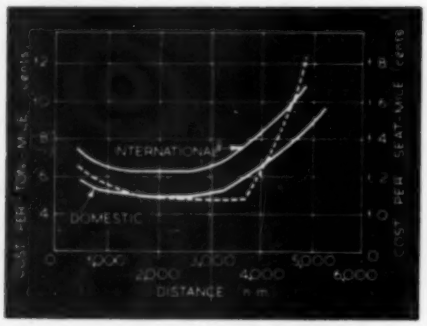
18 Periscopic
19 Buffet
20 Static aper
21 Forward c integral)
22 Rear cargo
23 Baggage d





24 Forward baggage hold
25 Rear baggage hold
26 Main windows, 19in × 14in elliptical
27 Emergency exits, 19in × 26in
28 Emergency doors, 24in × 48in
29 Toilet collector tank
30 Toilet discharge valve
31 Ice-protection strip
32 Control torque-tubes
33 Wing/fuselage main frames
34 Seat/cargo rails
35 Water tanks, 133 Imp. gal
36 Oxygen bottles
37 Baggage-hold Firex bottles
38 Drop-down oxygen masks in overhead stowage racks
39 Fifteen-man emergency rafts (fuselage); 20-man dinghies (wings)
40 Escape chute (fore and aft doors)
41 Coat space
42 9g seats, 32in pitch
43 Passenger door (withdraw and slide)
44 Cargo door actuator
45 Three aft toilets
46 Rear pressure bulkhead
47 Intakes electrically anti-iced
48 Ram air to cabin-air system, wing anti-icing and Zone 2 venting
49 Godfrey cabin blower
50 Blower intake
51 Blower delivery to heat-exchanger
52 Blower air spill
53 Heat exchanger (hot air)
54 Ram air to 53
55 Heated air from exhaust muff to 53
56 Hot air to cabin
57 Heat exchanger (cold air)
58 Ram air to 57
59 Refrigeration turbine
60 Cold air to cabin
61 Cabin air mixing
62 Conditioned air to cabin
63 Cabin air extraction
64 Cabin-air discharge valves (diff. 6.55 lb/sq in)
65 Individual cold air
66 Conditioned air to flight-deck
67 Ram air for wing anti-icing and Zone 2 venting
68 Air to rear end of exhaust muff
69 Heated air from muff to wing leading-edge
70 Nacelle structure (jet-pipe removed)
71 Firex bottles (CF 3BR agent)
72 Firewall zone 1
73 Firewall zone 2
74 Firex nozzles
75 Titanium structure
76 40 kVA and 60 kVA alternators (constant-speed drive)
77 40 kVA alternator (c.s. drive) and cabin blower
78 60 kVA alternator and cabin blower
79 Rolls-Royce Tyne 12 (engine-change unit)
80 Intake anti-icing air from intake guide vanes
81 Zone 1 venting
82 Alternator cooling air
83 Oil-cooler housing
84 Oil cooling air flap
85 Auxiliary gear-box
86 16ft de Havilland Hydromatic propellers
87 Inboard auxiliary fuel cells (1,640 Imp. gal)
88 Tank end-rib
89 Integral wing tanks (main, 7,594 Imp. gal; outboard auxiliary, 916 Imp. gal)
90 Booster pump
91 Fuel selectors
92 Fuel-tank vent
93 Fuel gallery
94 Engine fuel supply
95 Retractable fuel-jettison
96 Pressure-refuelling point, 500 gal/hr
97 Gravity filler
98 Inspection manholes
99 Flap actuator
100 Flap torque-tube
101 Flap screw-jacks
102 Flap guide-rails
103 Maximum flap angle 45 deg
104 Flap indicator switch
105 Spoiler, 48 deg up with max. down aileron-tab
106 Spoiler actuator
107 Aileron control-tab variable-ratio screw-jack
108 Bevel box, connecting inboard tab with rudder
109 Aileron override limit stop, and torsion bars
110 Aileron anti-float torsion bar
111 Wing section, root, NACA 25017, tip, modified 4413
112 Rearward retracting main gear, 40 x 12in tubeless tyres, Maxaret
113 Door actuation
114 Thermal-anti-iced leading edges
115 Combustion heater
116 Intake to 115
117 Combustion heater delivery to leading-edge anti-icing
118 Combustion heater access door
119 Elevator trim-tab
120 Elevator control-tab: variable-ratio actuator
121 Rudder control-tab: variable-ratio actuator
122 Control-lock cylinder
123 Fin attachment
124 Dielectric structure
125 Aerial coupler
126 Doppler aerial
127 H.F. fin-cap aerial
128 Bendix weather-radar scanner
129 Glide-slope aerial
130 V.H.F./V.O.R. aerial
131 Marker aerial
132 A.D.F. loops and sense aerials
133 Radar altimeter aerials
Skin thicknesses:—
134 .063in
135 .071in
136 .080in
137 .040in
138 .125in between main frames





Payload/range and fuel characteristics (left) and direct operating costs (right) for cargo (solid line) and 167-passenger (dotted) versions of the CL-44. International operation and 2-hr fuel reserve are assumed except for indicated domestic curve (¾-hr reserve); A.T.A. 1955 method is used for d.o.c.

CANADAIR CL-44 . . .

power for operating the cargo doors. The aircraft requirements are 2.1 lb/sec air at 3.32 pressure ratio plus 16 s.h.p. for engine starting; 2.164 lb/sec air at 3.32 pressure ratio for air-conditioning; and 25 s.h.p. for electrical power.

The Artouste and its associated alternator are mounted as a complete unit inside a canister which is suspended athwartships from structural frames in the nose compartment. Controls for the a.p.u. are duplicated at the flight engineer's station and in the nose bay, and air delivery for main engine starting is under the pilot's control. An hydraulic pump is mounted on an auxiliary-drive position on the engine to provide power for cargo-door actuation.

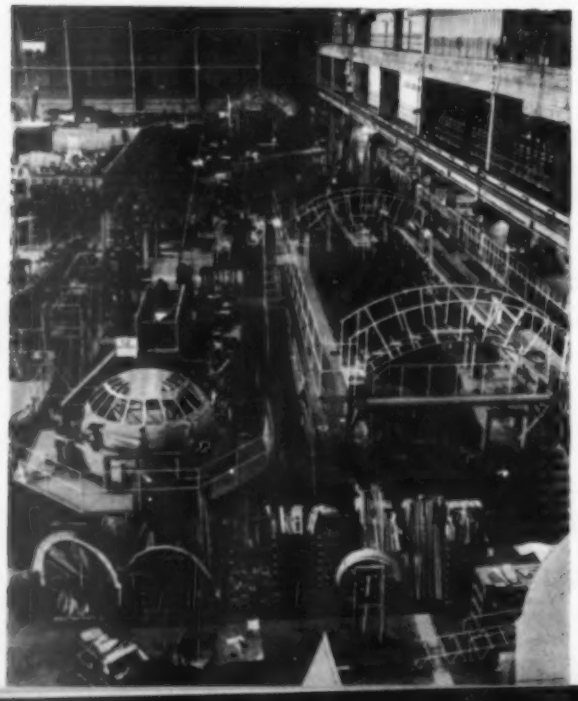
SYSTEMS. Flying controls follow Britannia practice, with the dual cockpit controls connected via gearboxes and torque tubes to trailing-edge servo-tabs and not to the control surfaces themselves. Inboard servo-tabs on the ailerons are connected to the rudder servo-tab system so that bank is applied and effective dihedral increased under yawing conditions. Artificial feel is provided for the elevator control by an hydraulically operated system which senses control displacement and I.A.S., and for the aileron and rudder controls by springs.

Cockpit instrumentation. Dual Collins FD-105 Integrated Flight Systems are installed, providing full instrumentation for V.O.R., I.L.S., glide-slope, heading and attitude displays.

Hydraulics. The main hydraulic system has an operating pressure of 3,000 lb/sq in. Pressure is supplied by two constant-delivery hydraulic pumps mounted on the constant-speed units of the inner engines, and provides the following services: (a) main and nose landing-gear retraction, extension and unlatching and main gear bogie-beam rotation, (b) nosewheel steering, (c) wheel braking, (d) control-surface ground locks, (e) front and rear cargo-door operation and (f) propeller brake.

Should the main hydraulic system fail, emergency operation of the landing gear and brakes is accomplished pneumatically.

Electrics. The main electrical system of the CL-44 is a 115V, 400-cycle system powered by three 40kVA, 208/120V, three-phase alternators, driven at 6,000 r.p.m. by constant-speed units on engines No. 1, 2 (standby) and 4 and designed to operate fully paralleled or independently. In addition, a variable-frequency A.C. system is supplied by three 60kVA alternators mounted in nacelles No. 1, 3 (standby) and 4. A secondary 28V D.C. system is supplied from transformer rectifiers fed by the primary constant-frequency A.C. system.



Part of the CL-44 shop at Canadair's Cartierville plant, Montreal, showing the first front pressure-structure (left) and major fuselage jigs

Radio and Radar. Typical equipment comprises: communications—dual Collins AN/ARC-38 H.F. transceivers and single Collins V.H.F. equipment (17L-7 transmitter and 51X-2 receiver); navigation—Bendix RDR-1C weather radar, dual Collins VOR-101 systems, dual Collins 51V-3 glide-slope receivers, marker beacon receiver, dual A.D.F. receivers, Edo Model 345 Loran, and radar altimeter, with complete provision for Marconi AN/APN-501 Doppler; audio—flight interphone, service interphone, and Collins 346D-1 public-address amplifier.

In connection with the H.F. equipment, dual Collins AT-102 aerial tuner systems are installed in the fin and rear fuselage.

Air-conditioning. A gear-driven positive-displacement type of air compressor mounted on each inboard engine draws air through a cowl-mounted ram air intake, compresses it and delivers it through a flow-control valve to the temperature control system. Each nacelle contains a primary heat-exchanger, turbo-compressor and secondary heat-exchanger cooling unit, and a series of valves to control air temperature by by-passing the cooler, modulating the cooling airflow through the primary heat exchanger, or diverting hot air over the primary heat exchanger from the tailplane muff. Separate crew-compartment and cabin temperature sensing elements control two independent mixing valves.

Passenger, crew and baggage compartments are pressurized at a working differential of 6.55 lb/sq in, corresponding to a cabin altitude of 8,000ft at a 30,000ft aircraft altitude. Regulation of cabin pressure is fully automatic, with manual override. Oxygen is provided for the crew and, by individual drop-down mask installations, for passengers. Oxygen storage is gaseous.

Anti-icing. Wing anti-icing is provided by ram air which passes over the engine tailpipes and is ducted into the leading edges. Tailplane and fin anti-icing employs a dual heater system installed in the aircraft tail. Electrical anti-icing is utilized for propellers, nose cowls, windshields, pitot heads, elevator horn balances, and the air intakes for cabin pressurization, heat-exchanger cooling and tailpipe muffs.

Payload Accommodation. The cabin of the CL-44 has a total length of 100ft 6in, a width of 11ft 5in and height 6ft 8in. In standard high-density configuration no fewer than 167 passengers are accommodated, eleven triple seats being located in the forward section and 42 triple and four double seats in the main cabin. Seat pitch throughout is 32in, and the central aisle is 15in wide.

In addition to the high-density version, economy and mixed economy/first-class layouts will be available. The first of these will carry 161 passengers at a 34in seat pitch, and the second will accommodate 108 economy-class and 22 first-class passengers.

The forward and rear underfloor baggage holds have capacities of 487 cu ft and 488 cu ft respectively, and the maximum baggage load (based on a permissible density of 20 lb/cu ft) is 19,500 lb.

Conversion from passenger to cargo operations will be possible, the available cabin volume being 5,950 cu ft. The six longitudinal floor-tracks provide 5,000 lb and 10,000 lb cargo tie-down points, and the aircraft's maximum cargo load will be almost 66,000 lb.

Even more impressive than the CL-44D in its potential is its projected successor, the CL-44E, powered by developed Tyne 11 engines. At a maximum take-off weight of 240,000 lb (maximum landing weight 200,000) this aircraft would carry a domestic payload (weight limited) of no less than 92,844 lb—lifting the payload/range characteristics well above the top of the scale on the diagram on this page.

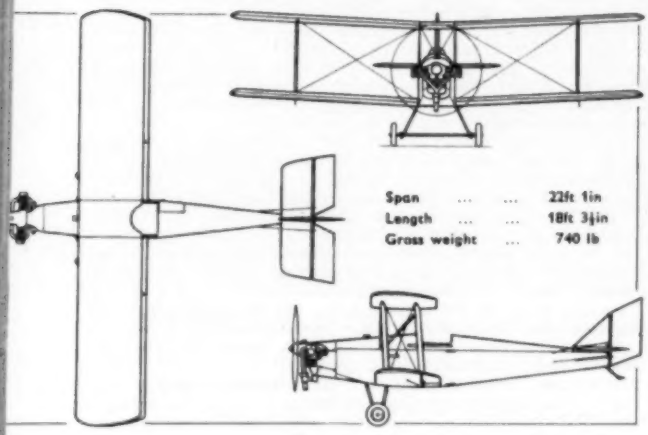
21-year-old Newcomer

CURRIE WOT IN SERVICE WITH HAMPSHIRE AEROPLANE CLUB AT EASTLEIGH

A RECENT project by members of Hampshire Aero Club has been the construction of a Currie Wot, a single-seat ultra-light biplane originally designed by J. R. Currie at Lympne in 1937. Two were amateur-built at Lympne in that year, but were destroyed during a bombing raid in 1940. The designer of the aircraft is at present maintenance engineer with the Hampshire club, and it was in co-operation with Mr. Currie that John O. Isaacs was primarily responsible for the construction of this third machine, G-APNT.

The Currie Wot has a spruce and plywood fuselage with a curved fabric-covered top, and fabric-covered spruce wings. It is powered by a 35 h.p. Aeronca-J.A.P. engine.

G-APNT is now on the strength of Hampshire Aero Club, who are building six more examples for sale at a price of £600 each. These will differ from the first in having rearward folding wings. This feature was planned from the outset, and accounts for the non-staggered wing configuration.



It is hoped that, by next Easter, trials will have started on a floatplane conversion of the type. The floats have been specially designed and are now being built by the Wessex Shipyard, at Bursledon, Hampshire.

A more powerful engine than the Aeronca-J.A.P. would of course be highly desirable for the aircraft, but the usual stumbling-block of the non-availability of a suitable engine at the right price is making itself felt. The Popular Flying Association are understood to have about ten Aeronca-J.A.P. engines, and there are probably a few more available in this country. Powerplants such as Walter Mikrons, Continentals and Volkswagens would confer an increased performance—at an increased price (the fitting of a Mikron is estimated to bring the price of the machine up to almost £1,000).

The Hampshire Aero Club, therefore, are going ahead with plans to design and build their own powerplant, which will be a 6-cylinder radial two-stroke delivering an estimated 55 h.p.

G-APNT is currently operating on a Permit to Fly, but the type is fully aerobatic and the makers hope that a full C. of A. will be granted. The airframe is stressed to 7g at 110 m.p.h. and 4g at 160 m.p.h.

The Currie Wot is essentially a home-built areoplane particularly intended for construction by amateurs. Sets of plans are available at £12 10s. It is designed to operate safely from small meadows or fields, imposing the minimum demands on garaging and servicing facilities. With a selling price rather less than the average economy car, it should give a useful stimulus to private flying in this country.

Dimensions and performance data include:—

Powerplant, 35 h.p. Aeronca-J.A.P.; span, 22ft 1in; length, 18ft 3¼in; gross weight 740 lb; empty weight, 480 lb; wing area, 145 sq ft; max speed, 75 m.p.h.; cruising speed, 60 m.p.h.; initial rate of climb, 350ft/min; endurance, 3 hr; take-off run, 150 yd; landing run, 85 yd; fuel capacity, 7½ gal.

THE PARIS SHOW

AMERICAN participation at the 23rd International Air Meeting at Le Bourget from June 12-21 will be on a greater scale than ever before. Eleven companies have made reservations. They are: Bendix, Boeing, Chance Vought, Convair, Curtiss-Wright, Douglas, International General Electric, Lockheed, Northrop, Republic, and United Aircraft (Pratt and Whitney and Sikorsky). Canada will be represented by Avro Canada and Orenda Engines.

MOSQUITO APPEAL

WORK on the erection of a hangar at Salisbury Hall, near St. Albans, to house the prototype de Havilland Mosquito is now being put in hand—although the appeal fund is still some way short of its target of £1,000. Among contributions recently received has been one of £200 from Rolls-Royce, Ltd., and Sir Geoffrey de Havilland and G/C. John Cunningham are among the many donors named in a list of subscriptions ranging from fifty guineas to 2s 6d.

Contributions should be sent to the Manager, Midland Bank, Ltd., 122 Finchley Road, Hampstead, London, N.W.3.

ONLY TEN SHOPPING DAYS . . .

PERHAPS because the average woman actually *likes* shopping, she is apt to begin her search for Christmas gifts well in advance. The average man, by contrast, neglects the duty until the last possible moment, with a breathless rush as the inevitable result. In the hope of easing this familiar situation, we offer a few suggestions (which, incidentally, may also be turned to good advantage if passed on as hopeful hints to relatives and friends).

For example, the various journals of Iliffe and Sons, Ltd., publish a wide range of books associated with the particular fields they cover. Here are some of the books, with their prices:—

Correcting Television Picture Faults, 3s 6d; *Improve Your Television Reception*, 5s; *Brighter Photography for Beginners*, 6s; *Motor Cycles and How to Manage Them*, 6s; *Scooters and Mopeds*, 7s 6d; *Caravanning and Camping for Motorists*, 8s 6d; *Boys' Book of Flight*, 12s 6d; *Car Driving as an Art*, 12s 6d; *Value-for-Money Motoring*, 7s 6d; *Photograms of the Year, 1959*, 18s 6d; *Yachting World Annual 1959*, 37s 6d.

Several Iliffe journals also publish useful and attractive pocket diaries associated with their particular interests; these include motoring, motor cycling, yachting, photography, farming (in this case a combined desk diary and year book) and nursing. Details and prices are obtainable from booksellers or from Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1.

ABOUT THE TECHNICAL PRESS

AN extremely useful guide to the various journals and other publications constituting the British trade and technical Press is now being distributed to leading industrial concerns, technical libraries and other organizations likely to be interested. Beginning with a foreword by Sir David Eccles, president of the Board of Trade, and an informative explanation of the aims and methods of specialized journalism, it goes on to list alphabetically some 358 journals, year books, etc., with relevant information about their publishers, the fields of activity they cover, and subscription and advertisement rates. This 112-page booklet is published by the Council of the Trade and Technical Press, Imperial House, Kingsway, London, W.C.2.

"Flight" photograph

World champion sailplane for 1958 was the West German HKS.3 (right), the single-seat version of the laminar-flow HKS.1. Incorporating a vee-tail, and wing-warping for lateral control and camber-changing, this sailplane has a span of 17.2 m and a wing loading of 25.7 kg/m². On the left is the Hungarian Sirály 2, with revised canopy, 17.6 m span and 25.3 kg/m² wing-loading

Leszno Retrospect

The 1958 Crop of Sailplanes: Impressions of Flying in the World Gliding Championships

THIS year's most significant gliding event, the world gliding championships held at Leszno, Poland, during the summer, produced a representative crop of the world's best sailplanes and, for pilots, a taste of the renowned East-European soaring conditions. In this article by Cdr. H. C. N. Goodhart, R.N., who achieved second place to Ernst Haase of West Germany in the open class of the championships, a pilot's impressions of the flying are given. The photographs illustrate an international selection of some of this year's most interesting sailplanes, as seen at the Leszno contest.

IN the minds of most glider pilots, Poland stands out as a place where gold and diamonds lurk in every cloud. Fabulous tales have been told of the ease of achieving that ultimate goal of most glider pilots, 500 km. The country being situated in the middle of a large continental area, we expected to leave behind us the damp, low-cloud, English-type of weather and to find ourselves in a country where dry winds and sun would give us near-to-ideal gliding, with a good chance of thunderstorms in the evenings to make things more interesting. It was therefore with a sense of pleasant anticipation that we arrived at Leszno, after four days' driving from England, at the beginning of the practice period some five days before the championships were due to start.

Already many teams had arrived, and we were able to look round the machines and get some idea of the competition with which we would be faced. My faithful Skylark 3 had come through the journey from England unscathed, but a quick walk round the gliders of the other competitors in the open class soon convinced me that the standards of the opposition were extremely high and we would be hard-pressed indeed to do any good, particularly if the weather lived up to what we were expecting. Many of the machines with which I was to compete were one-off designs built regardless of expense especially for this contest. Among these, the West German HKS 3, the Yugoslav Meteor and the Czechoslovak Spartak were outstanding. And so we came to the first day's practice.

At briefing, no task was set and we were free to get into the air just to inspect the local area and sample Polish conditions. There was no hurry, so after a leisurely rig we turned out to the starting point. And at once I got my first surprise. The tow-line joining me on to the very effective tug aircraft was only 20 metres long and, furthermore, it had no weak link. In the U.K. we use a tow-line of around 250ft length, so my expectations of an interesting tow were fulfilled. In fact, for the first three or four days, I found it quite definitely a full-time occupation to stay in place on tow, and it was only towards the end of the contest that I was able, as is my normal custom, to spend the time on tow getting the cockpit sorted out ready for the forthcoming flight.

The first thing that was apparent from the air was the incredible flatness of this area of Poland. And the next thing—a sight to gladden any glider pilot's eye—was the practically continuous supply of good landing fields. Apart from occasional woods, strip-type cultivation appears to cover the whole country and, as there are no fences whatever, it is possible to land practically anywhere.

Progressively during the practice period, the weather improved. First, the organizers set a 100 km triangle, which was easily completed by most competitors. Next day there was a 200 km triangle in conditions so good that the 200 km triangle records of many countries were beaten, including that of Great Britain (which was taken by Tony Deane-Drummond in the Olympia 419, who achieved a time one minute shorter than myself).

Finally, on the last practice day, they set a 300 km triangle which was completed in world-record time by Bozidar Komac of Yugoslavia, thus removing the only world record held by a British pilot. Again the task was completed by most pilots. This series of achievements shows better than any quotation of thermal strengths could show that Polish conditions were indeed up to the standards that we had all anticipated. As if to make us doubly sure, Sunday, June 22, was another first-class day and, although it was devoted to the opening ceremonies with no competitive flying, we heard that evening that a Polish girl who had been launched at 11.30 had achieved 500 km during the day.

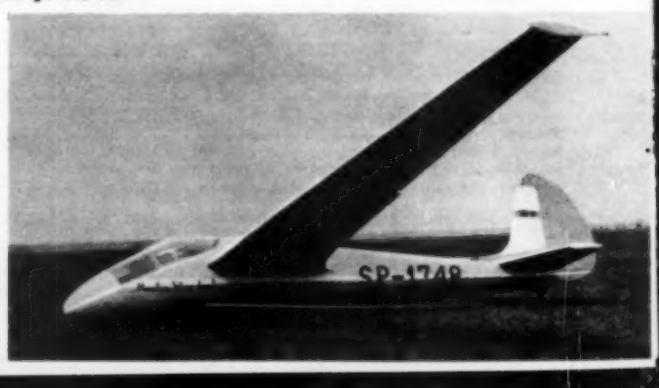
With all this behind us, the first competition day dawned bright and clear and excitement was tense as the task for the day—a race to Jelenia Gora and return—was announced. The total distance was 226 km. With the previous week's conditions in mind, and therefore expecting to average about 70 or more km/hr, I decided that I would not be in any hurry to cross the starting line, since the task would only take some three hours or so, and I naturally would achieve the best possible time if I arranged to make the trip during the best part of the day. It was at noon that I decided to set off but unfortunately, due to incompetence and the somewhat inadequate visibility from my cockpit, I failed to cross the line below the specified 1,000 metres and the rules required that I land and take off again.

It was not, therefore, until 12.30 that I finally crossed the line. Many of the opposition had not yet left, so I did not feel unhappy about this until I got half-way to the turning point when suddenly conditions deteriorated. Miserably I struggled along, thinking always that the others must be doing much better. A hoped-for thermal did not materialize and I was down to 300ft scraping in zero sink. But I must have prayed to the right saint for, after ten minutes' nerve-wracking struggle, slowly, desperately slowly, the ground began to recede. It took 35 minutes to get back to a safe height. And so on we struggled. Whenever I needed a thermal, there wasn't another sailplane in sight; whenever I found a thermal, the sharks would come and swim furiously around me until my wretched thermal gave up in fright.

At the turning point, conditions were dreadful. There were gliders to be seen everywhere and nobody was doing any good. However, I struggled round the turning point well below the maximum permitted height of 1,000 metres, and set off on what now appeared to be a hopeless struggle to get back. After 20 or 30 miles of the return journey, a long glide in absolutely calm air yielded nothing, and I started planning for a landing. But once again, at the last moment, I was just rescued by a pathetically

Representatives of this year's innovation, the 15-metre standard class: left, the Jugoslav Ilindenka being checked before the contest; right, the Polish Mucha Standart. Wing loadings are respectively 21.8 and 25.1 kg/m². A Mucha Standart headed the standard-class placings, and the type was a runner-up for the OSTIV standard-class design prize. Compared with the earlier Mucha-100, it has a new ply-covered wing and revised fuselage and tail

"Flight" photograph



In service with the Royal Air Force

Two years service with the Royal Air Force has established the Jet Provost ab initio/basic trainer as the best aircraft for its purpose, and the Mk3 is now in production for the re-equipment of Flying Training Command.

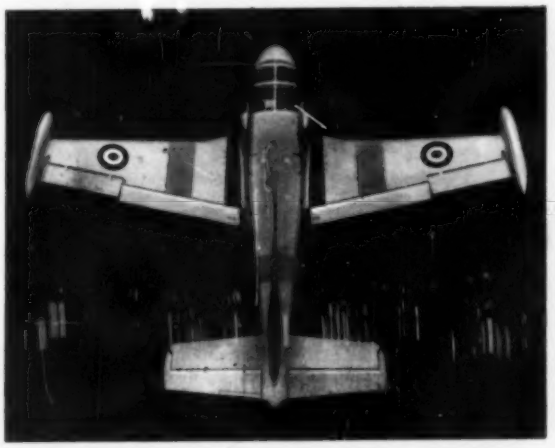
Improvements over the Mk1 include a redesigned undercarriage and windshield, a later mark Viper engine of increased power, increased fuel capacity and the installation of ejection seats.

Jet Provost

Powered by one Armstrong Siddeley Viper Turbo Jet.

The Jet Provost can be supplied to overseas air forces with or without ejection seats and can also be equipped with armament—machine guns, bombs and rockets—for use as a weapons trainer or as a tactical weapon.

Take-off distance, to clear a 50′ (15 m) obstacle...1990′ (606 m)
Climb:
Sea level to 10,000′ (3048 m) ... ... 5.0 mins.
Sea level to 30,000′ (9144 m) ... ... 23.0 mins.
Rate of climb at sea level ... ... 2380 ft./min. (12.2 m/sec.)
Max. level speed at 30,000′ (9144 m)...286 knots (530 km/hr)
Range (with tip tanks) ... ... 490 n. miles (910 km)
Endurance ... ... 2.45 hrs.



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Martin - Baker

AIRCRAFT COMPANY LIMITED OF ENGLAND AND CANADA

Two of the more sophisticated entries in the open class, the all-metal Jugoslav Meteor (upper photograph) and the Czech Spartak. The Meteor is of 20 m span and 31.5 kg/m² wing loading. The 16-metre Spartak has a gliding angle of 1 in 37 and employs sandwich construction, and is developed from the Démant, three of which are seen in the background to the lower photograph

"Flight" photographs

LESZNO RETROSPECT . . .

weak thermal from the village beside which I had expected to land. And now suddenly hope was renewed. Perhaps 15 miles ahead, cumulus clouds were to be seen and I knew that if only I could reach them I would almost certainly be able to get back. The punishment of Tantalus could not have been more cruel. As I slowly gained ground towards this promised land, the cumulus fringe slowly receded. But finally, some 30 miles from base I reached the first cumulus cloud and knew at once that I had made it. Suddenly all was gay and cheerful. Rates of climb instead of being infinitesimal were measured in hundreds of feet per minute. And it was no time at all before I started my final glide and crossed the finishing line.

It had been a dreadful trip and I was glad to find that many others had found it as difficult. Though I did not know it at the time, this was in fact the worst trip of the whole championship. But it did one very useful thing, and that was to teach me that Polish conditions could be just as difficult as British conditions and that in future I must watch my step.

The next task we were set was a 100 km triangle. In view of the weather, this seemed an unnecessarily short task, and once again we were faced with the problem of picking the best time to cross the starting line. With the struggles of the previous day still in mind, I chose to start fairly early, about one o'clock, and after enormous deliberation I chose to go round the course in the direction Leszno-Gostyn-Rawicz-Leszno, since a strongish wind was blowing more or less directly from Rawicz to Leszno and I did not want to fly a dead-into-wind leg.

The main interest of this trip was the careful planning necessary for the rounding of each turning point. The Polish rules required a maximum height of 1,000 metres in addition to the completion of a complete circle round each turning point. This complete circle demanded in fact a total turn of about 480 deg, and if one started at 3,300ft, it meant that one probably left at about 2,900ft. With a cruising altitude of 4,000-6,000ft, one had to plan each arrival at a turning point as a final glide. Squeezing three final glides and two recoveries from under 3,000ft (probably below 2,500ft after one had found a thermal from leaving a turning point) into a 100 km flight, practically necessitates an electronic computer in the cockpit if one is to put up the best possible performance. In fact in this case I fumbled the first turning point and wasted a couple of minutes. But, much worse than that, the direction I had chosen was in fact wrong and I took some 15 minutes longer than the best time to complete the course.

From now on, weather on task days was very much of British standard. Consequently my Skylark 3 was not so outclassed in performance as it inevitably was by the super jobs on the good-weather days.

The next task was a race to Warsaw, a distance of just over 300 km, but the task-setters had overreached themselves somewhat since no-one managed to reach the goal. This, perhaps, was not entirely a bad thing since the airfield for which we were aiming was on the far side of Warsaw, and a final glide straight over the middle of the city would undoubtedly have been a most nervous-making procedure. Imagine being at 600ft with three miles of nothing but city between oneself and the goal. Had one been higher than that, one would have been wasting time.

The start of this task was a particularly interesting one. The tugs rushed us into the air with their usual efficiency, releasing us as always at about 2,300ft, but it was immediately apparent that the thermals did not extend to this height and there then ensued a somewhat depressing glide downwards until one found oneself congregated with all the other machines in the only available thermal, swimming round like fish in a goldfish bowl. Some machines failed even to stay up at all. I concluded, however, that it might be possible to creep away operating with a maximum height of perhaps 1,700ft, so, after radioing to my crew to stand by for a really panic retrieve, I crossed the starting line and started to creep.

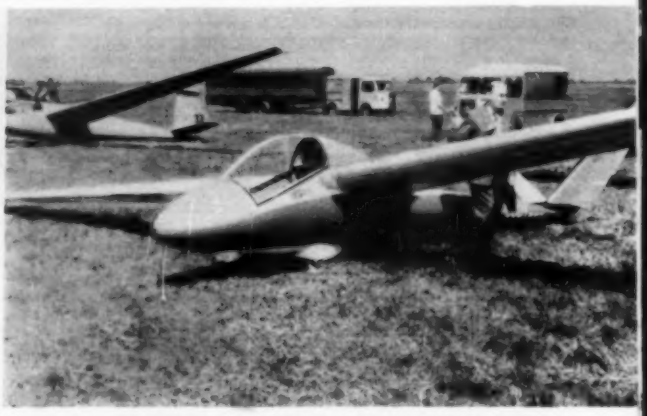
Within three miles I was down to 600ft with my crew patiently waiting on the road below me while I struggled pessimistically to make something of the pathetic conditions. After giving up at one time and heading back for the airfield, I finally managed to gain enough height to cross the first wood and we were off, with my faithful crew dribbling along the road below me and stopping beside every likely landing field while I struggled interminably. Some 30 miles out I passed 2,000ft for the first time, and things began to cheer up. In fact I even began to make my crew drive hard to keep up with me. But, as one might expect, a day that had started so poorly ended early and I found myself on the ground some 236 km from Leszno.

This was my first away-landing in Poland, and a most interesting experience it was. During the next couple of hours, I did some 14 km by bicycle, first to find a telephone and then to hang out my flag with a message attached to it as an aid to my crew to find me. I had radioed my landing position to my crew but, not having heard from them for the last couple of hours of flying, my transmissions had been somewhat half-hearted and I did not give them quite sufficient detail of my landing position. Nevertheless, I had just got back from my bicycle trip when I heard in the distance a roaring like thunder, which soon turned out to be my poor trailer bounding from bump to bump behind the car, as my crew quartered the countryside in search of me. And so back through the night to Leszno.

To everyone's surprise the next task, on a day on which perhaps six hours' flying was possible, was a race of 92 km to Ostrów, which could not possibly take more than two hours at the worst. The day was definitely a tricky one with good cumulus in patches, but also with some overcast here and there and large areas with no activity. The difficulty was to pick the right starting time. If one left straight away (first launch at eleven o'clock), one could be reasonably sure of getting there in time to come back and have another try later in the afternoon. On the other hand, if one did this one could so easily spend the best part of the day, say between one and three o'clock, driving furiously back from one's first try. I chose to delay my departure until what I hoped would be the best part of the day and to forego the chance of a second trip. It

A second runner-up in the OSTIV standard-class design contest this year was Finland's PIK-3c, a development of the 13-metre PIK-3. The fuselage of the earlier machine has been retained but the wing structure and geometry has been completely revised. The unconventional lower-wing vented spoilers are seen in the detail photograph on the right. Wing loading is 21.4 kg/m²

"Flight" photograph



"Flight" photograph

Winner of the OSTIV contest for standard-class sailplanes was the West German Kaiser Ka-6B (left), a simple and straightforward design with a wing loading of 24.2 kg/m². The most interesting newcomer was undoubtedly the trim lightweight Breguet 905 Fauvette (right) from France, which has a loaded weight of only 231 kg and is of mixed wood, ply/Klegecel sandwich, steel tube and glass-fibre construction

LESZNO RETROSPECT . . .

turned out to be a wrong decision, since the fastest times were made early and late. Nevertheless my time was not too bad and, as it turned out, the basic requirement was to get there. Several of the highly-placed pilots fell down on this particular trip, with the result that this became one of the more important days of the contest.

The rules for world championships require that the task "free distance" must be set at least once. Clearly, the Poles had been waiting for a good day to set this task, so that as many as possible could achieve the 500 km run to the Russian border. Though the forecast was not outstandingly good it clearly had 500 km possibility, and so we were off on free distance. The rules stated that distance would count only as far as the border of Poland, thus there was no point, whether one wished to or not, in crossing the Soviet frontier. A little circle-drawing based on Leszno showed that the Polish frontier was farthest away either towards the north-east or towards the east-southeast. The small bulge towards the east-southeast would in fact give the greatest distance; the wind, however, was forecast to be slightly south of west, except in the last stages of the flight. Possible heavy thunderstorms towards the north-east, decreasing towards the south, were forecast for the evening.

Weighing up all this information, I planned to try for the greatest possible distance towards the east-southeast despite it being partly cross-wind. It was a reasonably uneventful trip. Although the thermals were not strong, the following wind component was considerable and I was able to outpace my retrieving crew by a considerable amount (even though they report having put 96 miles into two hours which, considering that the maximum speed of the *equipage* was about 52 m.p.h. downwind with foot hard on the floorboard, is not bad going). As the evening wore on, it was clearly going to be touch-and-go whether I could reach the border or not. Unfortunately, the last cumulus clouds disappeared rather early at about five o'clock and by 5.30 I was on my final glide.

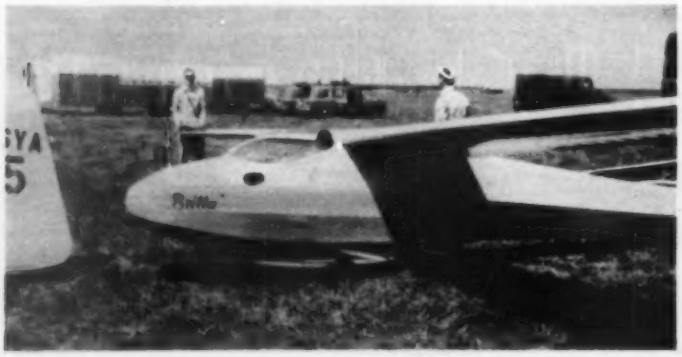
I could clearly see the Russian border about 12 km ahead, but I was north of where the bulge in the border occurred and, rather than head straight on and land by the border in what was obviously a completely trackless waste, I turned diagonally across track and followed the only road, thus throwing away about 5 km of distance in exchange for a retrieve which only took an hour from when my crew appeared on the road, instead of perhaps two days. My distance for the day turned out to be 514 km—the third time I had made almost exactly the same distance.

By now I had worked myself up to fifth place with very close marking in front of me except for Haase, who had established an outstanding lead. A lot would now depend on the choice of tasks.

Though we did not know it at the time, the next task was the last. It was distance along a straight line to the north-east. Like the trip towards Warsaw, the start was extremely marginal and I was out-paced by my crew. At one stage, I was even making no attempt to go forward since the sky in front looked completely dead. And another time I actually retraced my steps two or three miles in order just to stay up. Finally, after covering about 200 km, conditions suddenly changed with the appearance of a headwind and completely stable air. I have since realized that in fact this was sea-breeze effect blowing in from the Baltic. A short final glide gave me a total distance of 209 km. Tony Deane-Drummond was only a couple of kilometres behind me, and we were the leaders for the day. There was one simple reason for this and that was that we were ready at take-off time, as opposed to the majority of the other contestants; as a result we got first take-off and thus the farthest distance before running into the sea-breeze effect.

On the remaining three days the weather forecasts were such that flying was cancelled each day, and so the total of six days achieved constituted the contest. From my own point of view, this was perhaps a good place to stop since Haase was some 480 points ahead, whereas the next five behind me were all within 200 points. All the same, a few more days would certainly have been interesting.

The West German Zugvogel 4 (left) is a 15-metre version of the Scheibe Zugvogel 3 and employs a fuselage construction of welded steel tubes, faired by wooden stringers and fabric-covered. The chisel-edge wingtips are said to have the same effect as end-plates. The unusual elevator of the Hungarian Standard-Futar (right) is hinged well forward of the tailplane trailing-edge, giving the effect of a slotted control



Straight and Level

● *"I was flying in an old Dove,"* said King Hussein, *"which belonged to my grandfather."*—From the *Sunday Times* report of the King of Jordan's escape from Syrian Mig fighters.

The reigns of Hashemite kings may have been transient, but the reign of the de Havilland Dove has been enduring. Do not imagine, just because King Hussein's Dove belonged to his grandfather, that it has oil lamps, tapestried panelling, and iron tyres. Or that exuberant Rubens are painted on the cabin ceiling, or that the pilot's chair is richly gilded and jewelled. It is just an ordinary Dove, built for the Jordanian Royal House in 1948, and you could not distinguish it from the 1958 model.

No other transport aeroplane, British or American, has been in steady demand for so long, or has been so right from the day it first flew in 1945. I like to think of the Dove as a kind of old English tradition, a cherished craft handed down from Georgian days in defiance of fast-changing technical values.

The Dove is a sort of aeronautical Vicar of Bray, which has adapted itself not only to a world of ephemeral kingdoms, but also to a world in which aeroplanes are old almost before they are new.

● I must tell the Editor of *Flight's* new associate journal *Data Processing* about an electronic computer which will revolutionize the aircraft industry. It is known as a Meeting Simulator.

The makers, Thinx Electronics, Ltd., are soon to demonstrate a prototype of this equipment to aircraft firms and to airlines. The company's advertising slogan will be: "Before you call a meeting—Thinx."

My reporter talked last week to the chairman of Thinx, Sir Harold Digit-Smith, who explained Thinx's thinking. "Meetings are the curse of industry," Sir Harold declared. "Ring up anyone you like and ten-to-one he's out at a meeting. What do all these meetings achieve? In my view, nothing but a lot of pompous, sterile blather. There's no progress because key people are always at progress meetings because there's no progress."

Sir Harold explained how the Meeting Simulator works. The input comprises excuses, explanations, jokes to impress the chairman, sub-committee reports on redundancy, and so forth, all automatically programmed and processed via a Blather Filter direct on to punched tape. Within two seconds out pours the output in the form of neatly teleprinted conclusions and recommendations, all on quarto-sized paper prepierced for pinning on to works noticeboards, etc.

"Not only does the Meeting Simulator permit key executives to get on with the job," declares Sir Harold, "but think of all the coffee money you save, not to mention the green baize tablecloths which wear out at an appallingly high rate."

Straight and Level asked Sir Harold when the Meeting Simulator would be on the market. "As a matter of fact," he said, "we're having a meeting this very afternoon to decide just that."

The sun has finally set on the glories of the British flying-boat era. But do not feel too sad about Short Solent 2 G-AHIU and Short Solent 3 G-AKNS as they rest derelict in the ooze of Poole harbour. Someone has found a use for them. They will be joined together by box girders at the wing roots and tailplane roots, and then towed round the coast and up the Thames to London. There they will resume operations—as a coffee-bar

● You may recall the old story about the R.A.F. station commander who objected to having a telephone put in his office. "If anybody wants me," he announced, "they can get me on the R/T."

This leads me to muse on the fact that there are certain aeroplanes, particularly prototypes, which rarely seem to leave the ground. They are either just outside the hangar or just inside the hangar, and only off the ground when on jacks or trestles.

By contrast, an accessory salesman tells me that when he called on Boeing to see how his product was performing in the first B-52G he was advised that it might be several hours before the big ship landed. He asked when it took off, to receive the reply, "No idea—ages ago." In the same vein, a new advertisement for the Grumman Gulfstream twin-Dart executive machine takes the form of a letter from Mr. Grumman himself. It begins: "You are cordially invited to land your airplane at Bethpage to see the new Gulfstream." A better ploy might have been ". . . to wait for the new Gulfstream to land." Never give the customer the impression the thing's actually on the ground waiting for him.

● A good quote from the annual report of the British Independent Air Transport Association, which I have just been re-reading:—

"The independent airlines intend to pursue a policy which will provide safe, efficient and reliable transport at the lowest cost and this, they believe, can only be achieved by steady and regularized procurement and not by erratic or uneconomic mass procurement for prestige or other reasons."

● It appears that B.O.A.C. have, as they say, had the turboprop. But I wonder what they will do if ever T.C.A. or PanAm or K.L.M. decide to operate Canadair CL-44Ds across the Atlantic? These aircraft will be able to take full advantage of the propeller-discount fares which will, I believe, be I.A.T.A.'s solution of the complicated jet-fares controversy.

I think it is reasonable to predict that the CL-44D—the Rolls-Royce-Tyne-powered, 167-seat development of the Britannia described in this issue—will be the cheapest-to-operate long-hauler ever built. It could well happen that B.O.A.C. will find the transatlantic mass-travel market of the mid-sixties going to the derivative of the British airliner which they have apparently rejected.

● It might be an exaggeration to say that the following type of incident is always happening, but I think this one must constitute a record.

Last week, at an airfield near Harmony, Minnesota, student pilot Mr. Neil Haugerud swung the propeller of his "85 h.p. light plane." Unfortunately, the throttle was wide open, and the machine took off before the startled Mr. Haugerud could climb aboard. It "flew beautifully" for 45 minutes, reaching 5,000ft before it decided it had had enough.

● Those better versed than myself in the early history of airliner procurement might be able to tell me whether reliance could ever be placed on manufacturers' lists of "firm orders." As far as I can judge, manufacturers consider announcements of orders to be the spearhead of their promotional programme, while airlines regard such announcements as a device to influence route-licensing authorities.

A time-honoured ploy is to announce a new "order" when an aircraft already ordered by airline A is delivered instead to airline B. Another is the "phantom-order": no mention is made of an order that has been cancelled (Loftleidir's Electra is a case in point). Like a retired general, it just quietly fades away.

ROGER BACON

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

The Croydon Closure

OF the many reasons put forward officially for the proposed closure of Croydon Airport, none, as far as can be seen, holds much water.

The only one which I have not seen firmly and logically debunked in the aviation Press is that of the air traffic control problem in conjunction with Gatwick. The only words spoken on this subject seem to imply that it should be easy to co-ordinate the traffic, or for the two aerodromes to "avoid each other." This would necessarily complicate the already involved movements a controlled aircraft must make within the Control Zone.

The answer to this one is undoubtedly to let Croydon have the airspace up to—say—1,200ft, and let Gatwick have all the rest. Gatwick are not even interested in the space below this height, and Croydon will be quite happy with nothing more.

Closing Croydon is a very fine attempt to kill light aviation. It is like putting a bullet through the heart of a totally defenceless man, and then expecting him to live. He might; but even if he did, he wouldn't be feeling very well.

Oxford. C. M. LABOUCHERE.

British Private Flying

I SUPPOSE it is a good thing to try to look on the bright side occasionally—and in any case it is probably your job to do so; but, having gazed moodily over the top of my tankard at your leader last week, I gazed even more moodily back into the transparent bottom of it. In fact your leader contained about as much froth and as little substance as my tankard.

First, with full nostalgia, I regret the passing of Croydon. Secondly, I think it is wasteful, when you have good airport buildings and good hangars, night-flying equipment, met. and Customs laid on, to scrap them before you have to. Whatever is done about Biggin Hill or Gatwick as alternatives they are less accessible to London, and it would be more complicated to fly from either of them if you happened to be a serious private operator or if you used a light business aircraft. Nobody is going to argue when it is suggested that one cannot have airfields too near the centre of a city as big as London. But that is not to say the right sort of distance is 30 to 40 miles.

Then you turn to the several useful types sponsored by the P.F.A. I am sorry to have to tell you that the only use I have for a Turbulent or Turbi would be an occasional 15 minutes' *joie de vivre* flying round the circuit on a bright summer's day. Such lightweights are no substitutes for Gull, Leopard Moth, Proctor or Messenger. It also seems sad that these do-it-yourself aeroplanes with German motor-car engines should have to be dragged in at all. The only real aeroplane in the bunch you mention is the converted Chipmunk, and that is far from economical for the private or business owner; except for training, nobody really wants two seats in tandem and no stowage space.

And are there really "at least a dozen small privately owned fields scattered about this country . . ."? This is most impressive and means that if (as I hope) they are all carefully sited a would-be private pilot in any of at least a hundred major towns and cities of the country should have less than 100 miles to drive to get to his aeroplane!

London, W.1. C. LIPPE-TWYNGS.

The Bristol Scout

THE categorical refutation by G/C. Haylock (November 21) of the nickname ascribed by J. M. Bruce to the Bristol S.2A deserves an equally direct rejoinder. In fact this aeroplane *was* dubbed "Tubby" by the draughtsmen and riggers who built her; then, as now, they viewed their handiwork with pride and just a little affection.

If a brutal and licentious soldiery subsequently saw fit to apply an epithet which seemed to them more meaningful, that does not entitle them to claim that their nickname was the only one.

Bristol. C. H. BARNES.

Airframe Hours

ROGER BACON, I fear, strayed from his usual "Straight and Level" when he repeated what he saw in the original Cyprus Airways advertisement back in January. The owners of these two DC-3s claimed that they were "believed to have the lowest airframe hours of any airline Dakotas in the world." The totals were 12,228 for G-AKII and 13,748 for G-AGND.

In the same issue of *Flight*, in your classified advertisement pages, will be found DC-3s for sale at £23,500, complete with new C. of A. and with each airframe (since new) averaging only 4,000 hours.

Even B.E.A.'s hard-working fleet of 46 DC-3 Pionairs had, on March 31 last, five of the type which had less than 11,000 hours. And Roger Bacon might perhaps be interested to hear that considerable numbers of Indian Airlines' fleet of DC-3s (the world's largest, because they numbered 65 in March of this year) have probably the lowest airframe hours, both individually and collectively.

Nairobi, Kenya. DENNIS M. POWELL.

Comet and 707 Noise

I WISH to apologize for a mistake in my letter published in *Flight* for November 21. I quoted the altitude of the Boeing 707 at a distance of three miles from the start of take-off as being 400ft. This should have read 600ft.

The noise level of 113 db, as stated in my letter for this position, is, however, correct.

Rotherham, Yorks. JOHN F. WILBY.

An M.P.'s Misfire

I WAS amazed to hear in a recent B.B.C. Television broadcast of *Who goes Home?*, a Labour M.P. assert that "The R.A.F. still has no fighter plane that can fire its guns without the engine stopping." To deride the Royal Air Force and the British aircraft industry in this way is, in my opinion, quite despicable.

Statements of this sort, made as they are for the sake of dubious political capital, can only damage relations between the aviation industry and the party which the speaker represents. There are a great many people, perhaps as ill-informed as the Honourable Gentleman himself, who will believe these remarks. Perhaps those who know the true state of affairs will remember the apathy and general disinterest on the part of the Labour Party towards aviation and its problems when the next General Election is upon us.

Bodmin, Cornwall. JONATHAN EASTHOPE.

[The M.P.'s remark—though rather differently quoted—was the subject of a comment in our "Straight and Level" page last week.—Ed.]

The Von Richthofen Book

I AM sorry to see that your correspondent Mark Kennaway (November 28) does not approve of those people who complain of inaccuracies in "authentic histories," but is, instead, prepared to read anything provided it is beautifully produced. Well, the London telephone directory is beautifully produced but I imagine even Mr. Kennaway would complain if it proved as inaccurate as some recent books.

Anyway, if there had been a few more archivists in the past there would possibly be less occasion for the type of review and letter which are so disparaged. I have been trying to collate information on camouflage patterns used in the R.A.F. during the war and have found considerable difficulty in reconciling official requirements and makers' drawings, which agree with photographs, with so-called comprehensive and accurate books on the subject.

West Byfleet, Surrey. M. J. LEE.

Inflationary Spiral?

HAVING waited so long and so fruitlessly for the chance of paying less by travelling turboprop, can you tell me whether B.O.A.C. are in favour of a balloon-differential? I think most of us would travel in one if we could get a tenner off the trans-atlantic fare.

Bournemouth, Hants. NIGEL ROWLAND.

FORTHCOMING EVENTS

Dec. 15. R.Ae.S.: Discussion on Hypersonic Flow.
Dec. 16. Convertible Aircraft Congress, Philadelphia.
Dec. 17. Institute of the Aeronautical Sciences: 22nd Wright Brothers Lecture, "Means and Examples of Aeronautical Research in France," by Prof. Maurice Roy.
Dec. 17. Kronfeld Club: Christmas Party.
Dec. 17. R.Ae.S.: "Drone Aircraft," by H. G. Conway.
Dec. 18. R.Ae.S.: "Air Traffic Control Over the North Atlantic," by E. W. Pike.
Dec. 31. Kronfeld Club: New Year's Eve Party.
Jan. 6. R.Ae.S.: Young People's Lecture: "Astronautics," by Dr. L. R. Shepherd.
Jan. 8. R.Ae.S.: "Safety in Mechanisms," by Raoul Hafner.
Jan. 15. R.Ae.S.: Presidential Address.
Jan. 16. Institute of Navigation: "Blind Landing Problems," by W. J. Charnley.
Jan. 17. Aircraft Recognition Society: All-England Contest.
Jan. 21. Manchester Metallurgical Society (Institute of Metals): "Investigation of Metallurgical Failures in Aircraft," by D. A. Ryder.
Jan. 26-29. Institute of the Aeronautical Sciences: 27th Annual Meeting.
Jan. 27. R.Ae.S.: "The Noise Problem in Relation to Engine Design," by P. Lloyd.

R.Ae.S. Branch Fixtures (to Dec. 19): Dec. 15, *Henlow*, "Medical Aspects of High Speed and Space Flight," by W/C. W. A. Crawford. Dec. 17, *Southend*, Film Show. Dec. 19, *Weybridge*, Annual Dance.

. . . and before I could get a word in edgeways, he told
me that the amount of fuel an aircraft takes has gone up
from 3,000 gallons to 20,000 gallons in the
past ten years, and that the **BP Aviation Service**
is building fuellers which will hold 10,000 gallons each,
and deliver them at 750 gallons a minute.

Too much liquid's very fattening, you know.

AVIATION BP SERVICE

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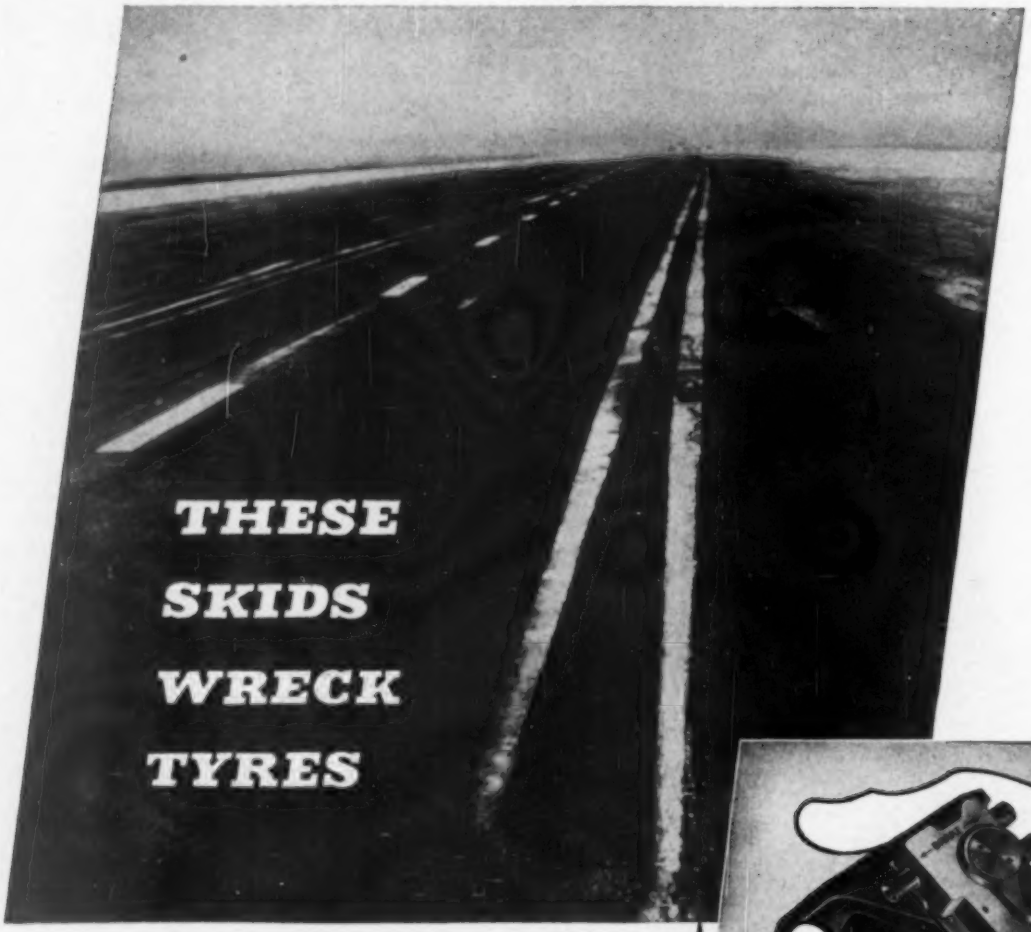
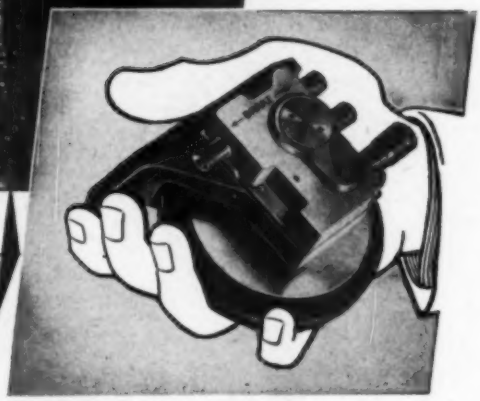
THE INTERNATIONAL AIRCRAFT FUELLING SERVICE OF THE BRITISH PETROLEUM COMPANY LTD.





---- THIS IS THE WAY TO STOP THEM!---

These runway skid marks, hundreds of yards long, are evidence of the destruction of four first-class aero tyres. Had the *aircraft that made them been fitted with Maxaret Anti-skid Units there would have been no skids and no tyre damage.*

The Maxaret, developed by Dunlop, is a device that keeps braking power at a constant maximum (with pilot-control right up to skidding-point) and totally prevents wheel skidding and tyre scrubbing damage. It enables the operator to get more landings per tyre and offers the pilot and passengers added security in emergency. The small, compact Unit, weighing only 4.7 lb., fits any size of wheel and makes no additional demands on aircraft services. Full details of the Maxaret are available from the Dunlop Aviation Division.

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DUNLOP RUBBER COMPANY LIMITED (AVIATION DIVISION) · FOLESHILL · COVENTRY

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THE INDUSTRY

M.L. a Public Company

IN the light of steadily increasing activities and turnover, the directors of M.L. Aviation Co., Ltd., and M.L. Engineering, Ltd., recently decided that a public company should be formed and application made for its shares to be quoted on the London Stock Exchange.

A non-trading company has accordingly been formed under the title of M.L. Holdings, Ltd., with M.L. Aviation and M.L. Engineering as main wholly owned subsidiaries, and with a capital of £500,000 in 5s shares. No changes have taken place in the management of M.L.A. and M.L.E., who will continue to trade as in the past. M.L.A. are research, design and development engineers in the mechanical, electrical and electronic fields, and M.L.E. undertake production.

M.L. Aviation entered the aircraft industry in 1940, when Mr. M. J. O. Lobelle, previously chief designer to the Fairey Aviation Company, joined the firm. Their products since then have included glider releases, tank hooks, and sliding canopies (these mainly during the war period); retractable gunsight mountings, target towing winches and signal pistols; automatic harness releases for ejector seats; radar trainers; and—currently under development and/or in production—mobile air-conditioning equipment; bombing gear; major components for rockets; dehumidification plant; guided-missile ground-handling equipment; pressurized helmets; and specialized electrical equipment and associated test gear.

Promoting Weight Engineering

HAVING among its aims the promotion of the application of weight engineering techniques in industry, and recognition of the science as a branch of engineering, a Society of Weight Engineers was formed earlier this year. At present most of its members are in aviation but it is hoped that membership will be widened to include representatives from many industries, for the mutual benefits accruing from an interchange of experience and information.

The Society has its headquarters at Holborn House, 113 High Holborn, London, W.C.1; its president is J. McLaughlin and the hon. secretary S. S. Morton, F.C.A. Two issues of a bulletin have already been published, the second in October. Its editor is J. W. Haggas, A.F.R.Ae.S., who is a member of the Society's council and chief weight engineer at D.H. Propellers, Ltd. The Society intends to issue its bulletin at quarterly intervals.

Durable Fan-Blade Surfaces

EXAMINATION of the fan blades used in the Aircraft Research Association's transonic wind tunnel at Bedford, after two years' operation, has shown that the phenolic-resin and fibre-glass covering devised for the blades has been entirely successful, state British Resin Products, Ltd. The resin used is the company's Epok phenolic spirit soluble J.1992, which was designed for application as a cold-setting lacquer for wood. The fan itself consists of two stages on a single shaft, and each 20-blade stage is of 21ft diameter on a hub of 8ft diameter. The fan blades, which were manufactured by Hordern Richmond, Ltd., are of Honduras mahogany.

Each blade weighs about 200 lb, and the centrifugal force at the hub at the maximum speed of 485 r.p.m. (a tip speed of 540ft/sec) is about 40 tons. The surface stress is thus very considerable—of the order of 1,000 lb/sq in—but, say British Resin Products, service experience has proved the suitability of Epok J.1992 for this and comparable applications in which a "diamond hard" surface is essential. The covering, they add, remained in excellent condition in spite of the operating temperature of about 60 deg C.

Connectors in Missiles

STANDARD "Unitor" plugs and sockets are being used in considerable quantities in Seaslug, Bloodhound, Thunderbird and Firestreak, state Belling and Lee, Ltd., of Enfield, Middx, the manufacturers of these components. An important factor is reliability in a situation where a storage life of some years may be involved.

Several manufacturers, add Belling and Lee, are considering the possibility of replacing the standard "Unitor" by the new miniature "Domino" connector, which offers valuable space- and weight-saving features. The same company's B.N.C. co-axial connector may be used on guided missiles in the near future.

Briefing the Customer

IN "gladly and confidently" commending the F.B.I. Register to readers all over the world the president of the Federation of British Industries, Sir Hugh Beaver, says in his foreword to this year's (31st) edition: "With the conscious struggle to raise general living standards in every country the demand for all kinds of consumer and capital goods, in spite of temporary slackening, is tending to rise from decade to decade. To meet this growing demand British firms can offer practically every type of product which commands a market, and it is to help prospective buyers that this annual publication is primarily intended."

The register, a comprehensive guide to a substantial cross-section of British industry, lists the products and services of over 7,500 member firms under more than 5,400 alphabetical headings. In addition there are seven other sections, giving addresses of companies and firms and useful information about trade associations, proprietary names, trade marks and so on. There are also French, German and Spanish glossaries giving translations of every product term used in the main buyers' guide.

Published for the F.B.I. jointly by Kelly's Directories, Ltd., and Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, the register (containing 1,140 pages) costs 42s post free.

IN BRIEF

The Minister of Supply, Mr. Aubrey Jones, opened the new headquarters of Vactric, Ltd., on November 26. Known as Vactric House, the new building—at 207 Sloane Street, S.W.1—is fully air-conditioned and claimed to be the first office block in London to be erected with this amenity.

* * *

Mr. K. S. Phillips, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E., has been appointed sales controller of Research and Control Instruments, Ltd. He was formerly with Siemens Edison Swan, Ltd., his last appointment being that of sales manager of the industrial valve division.

* * *

The forging of "difficult" alloys such as titanium, Nimonic, zirconium and aluminium bronze is the subject of a well illustrated brochure produced by Daniel Doncaster and Sons, Ltd., of Penistone Road, Sheffield 6. A section of the booklet illustrates the firm's activities in forging gas-turbine blades to high standards of dimensional accuracy and metallurgical structure.

* * *

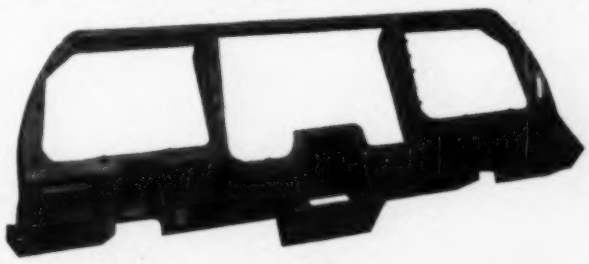
Mr. David John Wright, A.M.I.Mech.E., A.F.R.Ae.S., M.Inst.Pkg., has joined Barrett Packaging, Ltd., as chief engineer. Previously he was for three-and-a-half years with Export Packing Service, Ltd., and for the last two years chief engineer of E.P.S (Research and Development), Ltd. Earlier he had been in the aircraft industry, specializing in vibration and instrumentation problems.

* * *

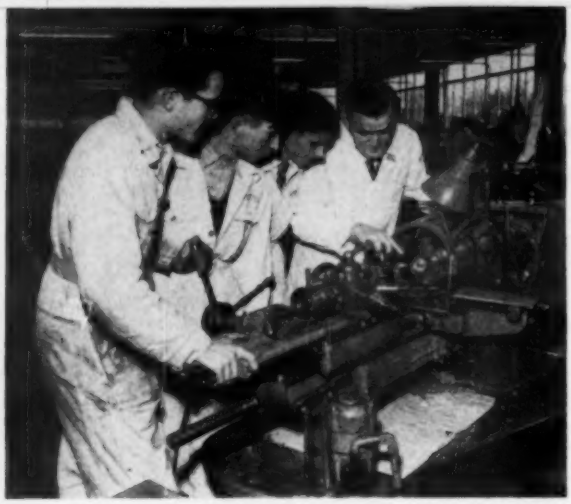
Two ranges of high-temperature plugs and sockets designed for operation in conditions of sustained supersonic flight have been produced by the Plessey Co., Ltd. These connectors, which are improved versions of the aluminium Mk 4 and standard ranges, have been subjected to stringent test, and the makers state that the two ranges have proved efficient at temperatures of up to +130 deg and +150 deg C, satisfying both the Ministry of Supply and Air Ministry requirements.

* * *

Firth Cleveland Tools, Ltd., Tipton, Staffs, a member of the Firth Cleveland Group, announce the appointment of Mr. F. A. Field as general sales manager. For many years he held a similar executive position with Black and Decker, Ltd. Firth Cleveland Tools manufacture the range of Surform hand tools distributed by Simmonds Aerocessories, Ltd., Stenor, Ltd., British Lead Mills, Ltd., and tool wholesalers.



Made from Bakelite polyester resins reinforced with glass-fibre materials, this instrument-panel frame for the Vickers Vanguard is an example of the complex shapes now being fabricated in these materials



"Flight" photographs

A general view (above, left) of the machine-shop at the Supermarine apprentice training school. Right, an instructor explains a point of detail

THE INDUSTRY . . .

PRACTICAL TRAINING AT SOUTH MARSTON

AIRCRAFT firms faced with diminishing orders have basically a choice of two courses to follow if they are to remain in business. One is to enter new fields of production with the same labour force; and the other is to decide how many workers they can continue to employ, then gradually reduce their numbers to this level by means of dismissals and/or normal wastage. Vickers-Armstrongs (Aircraft), Ltd., have adopted the first course in their Supermarine works at Swindon and have cocked an optimistic snook at the future by launching an ambitious new apprentice training scheme there.

The Supermarine works is on the north side of Swindon at South Marston, an airfield famous during the war years as the birthplace of hundreds of Spitfires and previously (up to 1942) as a production centre for Miles trainers built by Phillips and Powis, Ltd. Since the war Attackers and Swifts have been built there, and now Scimitars are being produced; but when production of the last-named for the Royal Navy ceases in 1960, the long line of fighting aircraft which has stemmed from the Supermarine factory will come to an end. Already Vickers have decided to concentrate their development of new aircraft at Weybridge; and as a corollary to this decision a new task has been found to diversify South Marston's activities still further—the design and building of nuclear reactors. An opportunity of seeing what is involved in this change, and of looking at the new apprentices' school, was afforded when the latter was formally opened (though it has been in action for some time) on December 2. This ceremony was performed by Lord Weeks, a director of Vickers, Ltd., who afterwards referred to changes in national and local conditions.

"The aircraft industry, as you are all aware," he told the apprentices, "is not going through an easy period; the recent diversification in this particular works' manufacturing activity is being reflected in the curriculum that you have to go through. Whereas stress was formerly laid on the aircraft application of general engineering, the scope is now being widened; and to this end a recent innovation has been the introduction into the school of a system of project work, whereby an order for the manufacture of an article is placed with the apprentice training department (in exactly the same way as an order may be placed on an outside company) and the whole project, from the basic planning to the ordering of material and ultimate manufacture is undertaken by the apprentices concerned."

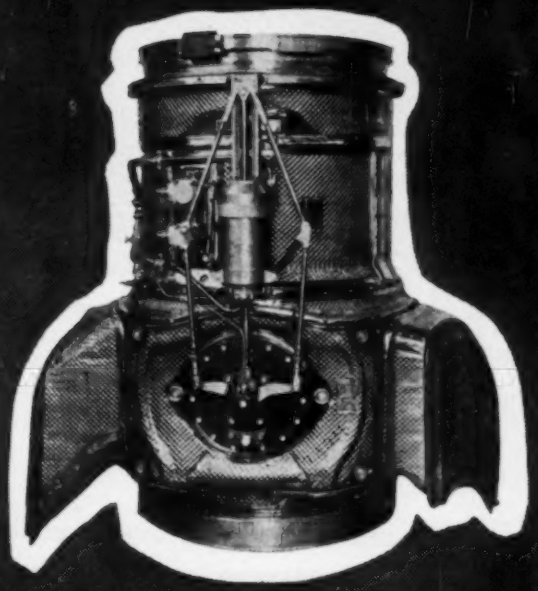
This commendable scheme, giving practical experience and a sense of purpose to the apprentices under training, has already shown good results. Several orders have been undertaken and successfully completed, among them a new design of pipe-belling machine and the construction of a Bensen gyro-glider. This type of aircraft (an adaptation of the rotor-kite towed behind U-boats during the war to widen their field of sight) has been sold in some numbers in the United States for sports flying. The one built at South Marston was recently given its initial test-flight—towed behind a jeep—by the general manager, Mr. S. P. Woodley.

The apprentices' school at South Marston (one of several training centres and schools within the Vickers group) owes its inception to Lord Weeks, whose interest in technical and industrial education has already been shown in the endowment of a new hall of residence at Imperial College. The school is adjacent to the main works, and its premises—covering an area of 11,400 sq ft—contain a machine-shop with generous window areas, a cinema for instructional films, lecture and common rooms, and administrative offices.

While the new school was under construction, a fundamental change took place in the general orientation of Vickers' activities at South Marston, following the Government decision about manned aircraft and its corollary that the industry would shrink in size as a result. Thus, while the apprentices are training to play their part in the future the shape of things to come is forming beside them in the factory. Scimitars are still being produced, but no other aircraft will succeed them on the production line (unless there is a dramatic change in national policy or international events); and in the commercial design offices and experimental department the design and building of nuclear reactors for research and training purposes is being pursued. In the course of his speech, Lord Weeks said that the Vickers group, as a whole, is "strongly entrenched" in the nuclear field; and earlier in the day the Supermarine general manager, Mr. Woodley, had remarked that aircraft workers are "a natural" for nuclear engineering. "Our job," he added, "is to develop ideas and to turn them into marketable products."

Below left, the gyro-glider built by the apprentices being test-flown; and at right, the company's deputy education officer, Mr. J. W. Jennings, gives his report on the year's work. On his left is Lord Weeks

"Flight" photograph



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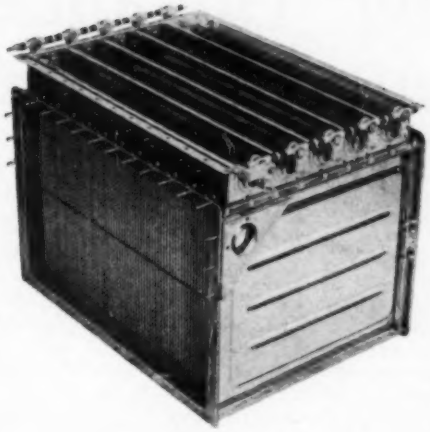

Heat exchangers for many purposes in both aluminium alloy and stainless steel. This particular example is for the Vickers Vanguard's anti-icing system. Similar units are being supplied for the Fokker Friendship, the Bristol Britannia, the Armstrong Whitworth Argosy, the Vickers Viscount and the Handley Page Herald.

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SW/57

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SPECIFICATION

Type Description	105T2H Integrating Tachometer
Excitation (Volts)	24
Frequency (C.P.S.)	400
Input current (Amps)	0·130
Input power (Watts)	1·9
Output Gradient (per 1,000 r.p.m.)	1 volt ± 0.2%
Phase shift with respect to input at 3,600 r.p.m.	0° ± 10′
In-Phase Fundamental at zero speed (mV) max.	2
Quadrature Fundamental at Zero speed (mV) max.	6
Total harmonic (mV R.M.S.) max.	10
In-Phase axis error (mV) max.	1
Quadrature axis error (mV) max.	1
Linearity: up to 4,000 r.p.m. (percentage of voltage output at 3,600 r.p.m.)	± 0.12%
Variation of output gradient with variation in ambient temperature —55°C to + 80°C	± 0·3% in magnitude ± 50′ phase shift
Shift in axis error with variation in ambient temperature — 55°C to + 80°C	± 10 mV in phase + 8 mV in Quadrature
Rotor Moment of Inertia (oz. —in.²)	0·094
Weight:	8 oz. for tachometer and 1 oz. for resistor
Drive	can be combined with 1·5″ and 1·8″ diameter servo motors

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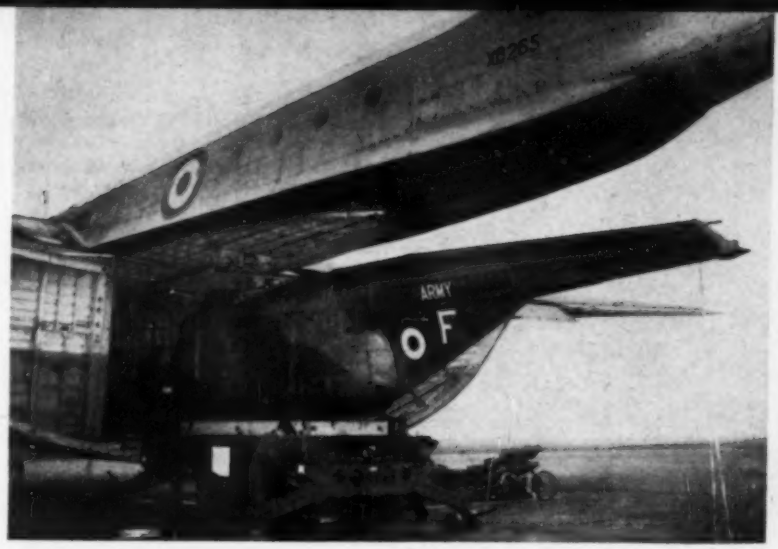


A Whirlwind of the Joint Experimental Helicopter Unit, one of six being sent to Cyprus, is loaded into a Beverley at R.A.F. Abingdon

SERVICE AVIATION

Royal Air Forces and Naval Flying News

R.N. Scimitars Cleared

AN Admiralty order grounding R.N. Scimitars, following the accident on November 19 when a pilot from R.N.A.S. Lossiemouth died of injuries after ejecting at low level, was rescinded last week. Two other Naval aircraft which had been similarly grounded, the Sea Vixen and Hunter T.8, were cleared for flying as from November 25.

Naval Aircraft Director

APPOINTED to succeed Rear Admiral J. P. W. Furse next March as Director-General, Aircraft, Rear Admiral E. Mill is a specialist in marine and air engineering. He became superintendent of the R.N. aircraft yard at Belfast in 1954 and was until recently Fleet Engineer Officer on the staff of the C-in-C. Mediterranean at Malta.

Rear Admiral Furse has since September 1955 been successively Director of Aircraft Maintenance and Repair, Director-General of the Department of Air Material and Director-General, Aircraft.

Clipped-wing Gannet

A NAVAL pilot, Lt. E. S. E. Taylor, landed his Gannet safely at R.N.A.S. Eglinton recently after the 9ft outer panels of its wings (including the ailerons) had been torn off by loading subsequently assessed at about 8g.

The story is a tribute to both pilot and aircraft. Lt. Taylor was making R.P. attacks on a range near Eglinton and had Leading Radio Operator (Air) P. J. Watson as aircrewman. The aircraft was pulling out of a dive, at an angle of less than 40 deg, when it encountered the slipstream of the Gannet which had preceded it to the target. Although there was the normal 30 sec interval between the two aircraft, in the extremely calm conditions prevailing the turbulence failed to disperse. When he saw the damage caused, Lt. Taylor headed towards the sea to bale out; but when he found he still had control he returned to Eglinton and made a successful wheels-down landing, approaching at 125 kt to avoid stalling.

The Fairey Aviation Co., Ltd., say the Gannet involved (a four-year-old AS.1) suffered stresses well beyond its design ultimate case.

Fighter Group Post

HAVING been Commandant of the Central Fighter Establishment since 1956, A. Cdre. E. L. Colbeck-Welch has recently taken up a new post, that of S.A.S.O. at No. 13 (Fighter) Group headquarters. Prior to going to the C.F.E. he had taken the 1956 Imperial Defence College course. He is an O.B.E. and won the D.F.C. when commanding No. 29 Sqn. on wartime night-fighter operations.

H.M.S. "Eagle" Returns

AFTER 16 months in commission, H.M.S. *Eagle* returned to Plymouth on December 3. During this period she had sailed to the Arctic Circle and (during the Lebanon and Jordan crises) to the Eastern Mediterranean, and into the Black Sea for a visit to Istanbul. The carrier has co-operated with the French Navy in carrying out deck-landing trials of the Bréguet 1050 Alise and Fouga 170 Magister Marine, while *Eagle's* Skyraiders, Sea Hawks, Venoms, Wyverns and Gannets have made over 10,000 and her Whirlwinds more than 2,000 landings. She has steamed over 65,000 miles on this commission and her aircraft have used 90,000 tons of avcat and (according to the Admiralty) "enough high-octane fuel to take the average family saloon car nearly 6½ million miles."

Commanded by Capt. J. B. Frewen, R.N., the carrier is to sail for the Mediterranean after Christmas leave for her crew. When this present commission is completed, about the spring of next year, a start is to be made on modernizing H.M.S. *Eagle* to enable her to operate Scimitars and Sea Vixens.

Recent Appointments

AMONG Royal Air Force appointments recently announced by Air Ministry are the following:—

G/C.s W. G. Devas to R.A.F. Thorney Island, to command; and A. R. D. MacDonell to R.A.F. South Cerney, to command.

W/C.s D. H. Beckett to H.Q., British Forces Aden Peninsula, for technical staff duties; G. Davidson to AAFCE, for staff duties; K. J. B. Dunlop to R.A.F. Dishforth, for technical duties; R. A. B. Ellis, R.C.A.F., to H.Q., Fighter Command; J. B. Evans to R.A.F. Valley, for technical duties; M. G. L. Foster to R.A.F. Uxbridge, as President of the Ground Selection Board; J. Hurry to R.A.F. Bruggen, 2nd T.A.F., to command No. 80 Sqn.; C. J. Mackenzie to Air Ministry, for duty in the Department of the C.A.S.; P. A. C. McDermott to H.Q., Bomber Command, for administrative planning duties; E. H. Maule to Ministry of Supply; and F. G. B. Randall to No. 12 School of Tech. Training, to instruct.

IN BRIEF

W/C. W. B. Thorburn, of the R.A.F. Medical Branch, has been awarded the Lady Cade Medal for his work during the Asian 'flu epidemic last year when he was senior medical officer at R.A.F. Cosford.

* * * * *

A nativity play performed by a cast from R.A.F. Uxbridge will be given in St. Clement Danes, the R.A.F. church next Tuesday (December 16).

* * * * *

U.S.A.F. activities at R.A.F. Burtonwood, Lancashire, are to be terminated and the airfield returned to Air Ministry control in the latter part of 1959. Some 1,400 British and 50 American civilian employees and 900 U.S. military personnel will be directly affected.

* * * * *

There are 800 vacancies for boys aged 15½-16½ to enter the R.A.F. next February as Boy Entrants. Details of the conditions of entry and service are to be found in A.M. Pamphlet 340 (June 1957), obtainable on request from the Central Recruiting Office, Air Ministry, London, W.C.1, or from any R.A.F. recruiting office in the U.K.

Hail and farewell: Air Marshal Sir Andrew McKee, A.O.C.-in-C. Transport Command (below, left) during his round-the-world flight in a Comet 2, being greeted at Richmond, Australia, by A. V-M. C. D. Candy, A.O.C. Home Command, R.A.A.F.; and at right, Air Marshal Sir Hubert Patch saying farewell in Cyprus on relinquishing his appointment as C-in-C., M.E.A.F.

"Flight" photograph

The RW.3 Multoplane Porsche-powered two-seater, forthcoming production of which in South Africa is reported on this page

Club and Gliding News

NEW purchaser of a British-built Turbulent ultra-light is A. Cdre. G. J. C. Paul, the recently appointed secretary-general of the Air League of the British Empire. Registration of the machine, which will be delivered by Rollaston Aircraft and Engines, Croydon, in the new year, is G-APMZ. Other Turbulent news is that a full-size demonstration model has been built by Rollasons and is now being exhibited by the Popular Flying Association at department stores throughout the country.

PROSPECTS for the construction in South Africa of U.S. and German light aircraft were reported recently. In Durban, a new company has begun to build the first of a series of aircraft (unidentified U.S. two-seater type) which will sell at £1,300-£1,400. In Hattingspruit, Northern Natal, two German engineers, Helmutt Schutte and Otto Martin, plan to build a factory for the assembly of RW.3 Multoplanes from parts exported from Germany.

A SOARING flight between the capital cities of Argentina and Uruguay was achieved on November 16 by Rolf Hossinger, flying a Slingsby Skylark 3. This flight involved a 40-mile crossing of the mouth of the River Plate and the total distance flown was 166 miles. Hossinger was launched from a Stearman aerotow over the Albatross Gliding Club site at Merlo Airfield, Buenos Aires at 2 p.m., attained a height of 6,000ft between the airfield and the coast, and crossed the river with a loss of height of only 200ft. Over Colonia, on the Uruguay coast, he found very strong thermals and reached his maximum height of 9,000ft. The Skylark arrived over Adami Airfield, Montevideo, with 3,000ft in hand.

The first glider crossing of the River Plate was made in 1937 by Hans Ott, who flew from Colonia to Quilmes in a Condor. This 30-mile crossing, however, was accomplished in a straight glide from 6,000ft and did not involve soaring flight. Last month's flight by Hossinger, a Gold C pilot who represented Argentina at Leszno this year, has aroused great interest in soaring in Uruguay and has heightened the existing enthusiasm for the sport in Argentina. Gliding was popularized in the latter country by German pilots in the 1930s. The sport is now government-sponsored in the national interests of training pilots. The State not only has subsidized the clubs at a fixed rate per pilot, but also has assisted them by donating kits and, in some cases, complete sailplanes, and in addition makes available tug aircraft on loan. Student pilots are expected to pay for their training in the normal way.

A revised scheme, due to take effect from January 1, will require clubs to pay 50 per cent of the cost of gliders and tugs. The government will pay the remainder and will give the clubs long-term credits to help in paying their share. While this will mean some financial difficulties for the clubs, it will result in the aircraft remaining the clubs' own property.

ON Sunday morning, November 16, Dr. Kwame Nkrumah, Prime Minister of Ghana, and many other distinguished guests paid a visit to the Accra Gliding Club at Afienya, near Accra in Ghana. The occasion was the second Open Day held by the club since its formation eighteen months previously.

The founder of the club [a correspondent writes] was Gerry Burgess, a soils engineer, and its first chairman was Lt-Col. R. E. S. Skelton. The club's first active step was to order a Slingsby Tandem Tutor from the United Kingdom. The interval between the decision to buy the glider and its arrival was a long and busy one. A suitable site had to be selected and negotiations opened with the local chief for the use of the land; the strip had to be levelled and marked out and a hangar built; a tow car had to be acquired, instructors found and members given some ideas in advance of all the arduous duties connected with the sport of gliding.

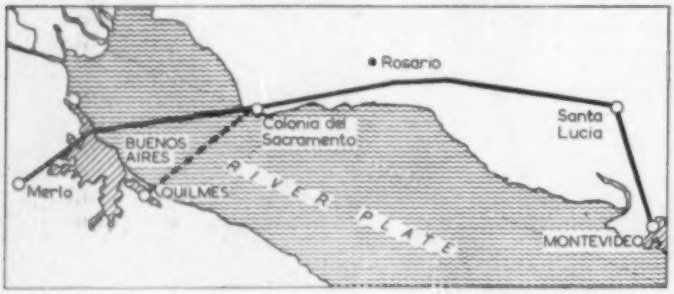
Every weekend members turned up with their own tools and equipment to prepare the site. Materials were scrounged; bull-dozers were borrowed; a strip was levelled and a hangar was made from flattened 40-gal tar drums. Eventually, in March 1957, *Comfort*, as she became affectionately known, arrived by sea at Accra. The club's troubles, however, had only just begun. On opening the crates her wings and fuselage were found to be so badly damaged that all thoughts of flying had to be put off for many more weeks. Among the founder members of the club was an ex-Luftwaffe ground engineer, Karl Tiede, and another engineer named Steve Theuss. Between the two of them the fuselage was patched up and a brand new pair of wings was obtained through the insurance company. The new wings arrived in July—also broken, but not too badly, and were soon repaired. *Comfort* took to the air in earnest in August 1957 and, apart from the occasional fits of temperament to be expected of any lady and one three-week period when she broke her fuselage and had to be grounded, she has remained airworthy every weekend since.

In his chairman's report for the year ending July 1958, Dick Skelton reported that *Comfort* had completed 2,360 launches since flying started, and twelve pilots, only three of whom had had any previous flying experience, had obtained their A and B certificates. Three pilots had won their C certificates, and *Comfort*'s main achievement was that, with two up, she had remained airborne on one occasion for 53 minutes. The Tandem Tutor, however, could not satisfy the experts and so six enthusiastic members formed themselves into a syndicate and purchased from Germany a Spatz single-seater. The club has now ordered its own single-seater which is expected before Christmas.

At present the club has some 40 active members, of whom 16 have been taught to fly solo since the club started, and *Comfort* and the Spatz have between them logged a little over 4,000 launches. Members have also built a much larger hangar.

For the Prime Minister's visit a small club-house was erected on the airstrip. Mr. Nkrumah took a keen interest in all that was going on and stayed for over an hour. After his departure many guests, including Mr. Archie Casely-Hayford, M.P., who was the Minister responsible for aviation when the club started, were given joy rides. Although not wealthy, the club is now well-established and flourishing.

THE Association of British Aero Clubs have invited suggestions from club members and others for a motto to be adopted by the Association. Brevity and relevance to the Association's aims will win £10 for the person sending in the entry chosen by the A.B.A.C. Council.



Swedish - Argentine glider pilot Rolf Hossinger and a map of his flight from Buenos Aires to Montevideo (see news item above), with the previous River Plate crossing by Ott shown dotted

Desoutter in the Aircraft Industry

Please don't think you can build an aeroplane faster than the next man. The next man also uses Desoutter power tools. In fact, these powerful, beautifully-made tools are used by every aircraft manufacturer in the country.

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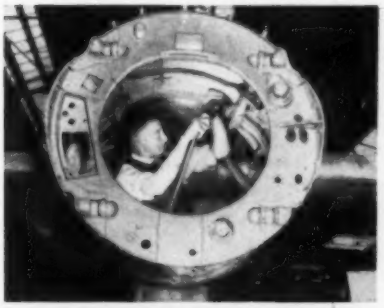
The Mighty Atom Corner Drill reaches any awkward spot. This M2 model is being used on the engine mounting of a Vickers Viscount. *Photograph by courtesy of Vickers-Armstrongs.*



A Desoutter Rackfeed Drill reaming holes in the centre section of an Avro Vulcan bomber. *Photograph by courtesy of A. V. Roe & Co. Ltd.*

Another widely used tool in the aircraft industry is this Desoutter Bolt Miller.

Drilling and countersinking rivet holes with Desoutter power tools on the fuselage skin of a Vickers Vanguard. *Photograph by courtesy of Vickers-Armstrongs.*

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Capital Airlines figures emphasise original economy claims of the Viscount 700

These figures are taken from a study of operating costs recently made by Capital Airlines. The original estimates made in May, 1954, are compared with actual costs experienced in service.

Cost per aircraft-hour flown	*Original Estimate*	*Actual 6-months period ended 30th June, 1958*
DIRECT EXPENSE		
Pilots' salaries, travel; engine fuels; hull insurance; etc.	$ 96.15	$ 95.85
Direct maintenance labour, materials	57.76	47.12
Aircraft depreciation	45.91	46.36
Total direct expenses	199.82	189.33
INDIRECT EXPENSES		
Assigned expenses (of all other elements of operating expense allocated to types of aircraft on a formula basis)	$169.52	$169.20
Total operating expense	369.35	358.53
Costs per revenue aircraft-mile flown		
DIRECT EXPENSE		
Pilot's etc.	$ 0.402	$ 0.383
Direct maintenance	0.242	0.188
Aircraft depreciation	0.192	0.185
Total direct expense	0.836	0.756
INDIRECT EXPENSE		
Assigned expense	$ 0.709	$ 0.697
Total operating expense	1.545	1.453

It's experience—backed by figures like these—that is built into the Viscount 810/840

VICKERS VISCOUNT 810/840

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CIVIL AVIATION

Up-to-date with the Friendship

THERE have been reports recently that the Fokker-built Friendship has been in fatigue-test trouble. For example, it has even been suggested that T.A.A. were considering the cancellation of their order for 12 aircraft. This particular story, and certain other whispers about the Friendship structural-test programme are now known to be untrue. The Fokker company, in their best "full information" tradition, have prepared a report which should be available in the next few days.

In the meantime it appears that, about half-way through fatigue-tests on a production specimen, there was a failure of the lower skin in the region of the wing-root. The remedy was to stiffen the weak area by re-skinning with heavier-gauge material. Unfortunately, nine production aircraft—for Aer Lingus, T.A.A. and Braathens—were too far advanced for the modifications to be made at the production stage without causing considerable delays. Accordingly, these aircraft will be returned to Fokker for modification before the completion of 5,000 hr operational service. It is appropriate here to quote Mr. J. K. Watkins of T.A.A.:

"The outcome of the series of conferences with Fokker must, in my opinion, be regarded as most satisfactory. The modification, which has now been agreed upon, should completely eliminate any likelihood of fatigue problems in the lower skin and stringer assembly of the F.27 centre wing within the agreed-life objective of 30,000 flights [*sic*], and this is far in advance of anything demonstrated or achieved in service by any other known type of civil aircraft."

Latest commercial news about the Friendship is that, as from January 1, the price of the R.Da6-powered version will be increased from 2.1m guilders to 2.3m guilders. Both these prices are without plug-in radio units, and are equivalent to £199,000 and £218,000 respectively. Fairchild's price is equivalent to £226,500, having been increased on November 30 from £210,000.

There has been some confusion as to what proportion of the Friendship's value is represented by British components. Fokker have always said "about 30 per cent"; but Aer Lingus have recently been saying "about 60 per cent." The discrepancy is attributable to the differing viewpoints of maker and user. For example, Fokker buy from Britain Rolls-Royce Dart powerplants; Rotol propellers; Dowty undercarriage; Dunlop tyres, wheels and Maxaret brakes, and pneumatic-system equipment; Godfrey cabin blowers; Redux; and other equipment and materials. The value of all this, as a proportion of today's £199,000 price, is £64,000—i.e., just over 32 per cent.

The Aer Lingus figure of "60 per cent British" is possibly a more valid measure of the export business which Fokker and their Fairchild licensees have procured for the British aircraft industry. It takes account of the fact that during the operational life of an aircraft most of the spares and replacements are "bought-out equipment," which would be almost entirely British.

It is difficult to measure the precise Customs duty on Friendships imported into the U.K., nor is it possible to assess the adverse effect of such a duty upon U.K. sales. Those U.K. operators who can afford to buy new DC-3 replacement equipment could, of course, purchase Handley Page Dart Heralds, whose first cost is substantially less than that of the Friendship even without duty. For the record, the proportion of the Friendship's value which would be subject to duty would be the basic price less 32 per cent—i.e., £135,000. Taking the present import duty of 17½ per cent, cost of a Fokker-built Friendship bought today in Britain would be about £233,000.

The proportion of the Fairchild-built Friendship which is British is rather less than 32 per cent, since the American firm has adopted some "native" equipment. Nevertheless, adding up the total number of Fokker and Fairchild Friendships sold to date (57 and 74 respectively), and assuming the "60 per cent British" value quoted by Aer Lingus, it is apparent that the Friendship has so far done about £16 millions of export business for the British aircraft industry.

T.W.A. SEEK FINANCE . . .

THE Cherington report on the re-equipment programme of American airlines revealed that the value of equipment still to be covered by suitable financing arrangements amounted to no less than $750m, by far the largest unsatisfied commitments being $313m for T.W.A. and $115m for PanAm. A few weeks ago PanAm announced that their arrangements had been completed.

An article in the December 1 issue of *Time* discusses the problem facing T.W.A.'s owner, Mr. Howard Hughes:—

"Mr. Hughes is in the midst of a $500m re-equipment programme for T.W.A., has paid for 20 new piston-engined Super Constellations recently delivered, but still owes something like $320m for 30 Convair 880s and 33 Boeing 707 jets on order.

"In times past, owner Hughes could be counted on to pick up the tab for losses. But Hughes is having troubles in other parts of his empire. Hughes Tool Co., which is financing T.W.A.'s new jets, is in no position to absorb more heavy losses . . . Nor can the second highly successful wing of Hughes' empire, Hughes Aircraft Co., help much.

"What will he do? The West Coast has been buzzing for months that he might sell all or part of his empire. The 78.2 per cent T.W.A. stock interest, plus Hughes Tool and Hughes Aircraft, could bring anywhere from $350 to $500m. Against that figure, Hughes must count debts and commitments of $427m: some $87m in accumulated debts at T.W.A., another $320m in jet-airliner commitments, plus about $20m in personal debts from his movie deals.

"A more likely alternative is that Hughes will try to dig up enough cash to hold out until the new jets are flying and become assets instead of liabilities. One solution would be to go to the public, sell stock in Hughes Aircraft to meet operating expenses and float long-term bonds in Hughes Tool to meet jet payments when deliveries start next year."

The first five production Caravelles are taking final shape at the main Sud assembly plant at Saint Martin du Touch, Toulouse

. . . WHILE NORTHEAST SEEK SUBSIDY

ANOTHER U.S. airline in a bad financial way is Northeast. Its entry into the long-haul business has failed to improve the profit record, indeed the unexpectedly low load-factors experienced on the New York-Miami service has led to results being even worse than before. Over the first nine months of this year, Northeast's loss amounted to some $5m, of which $2m arose on the local service network in New England.

The airline applied to the C.A.B. two months ago for payment of subsidy on the local-services, and the Board has now allowed an increased temporary mail rate that will meet Northeast's "urgent need for additional working capital." The subsidy will amount to almost $5m, and will cover deficits on local services from February 1957 until the end of this year. It is then expected that a final mail rate will be established.

To cover current operations the airline has already become involved in considerable debt: The Atlas Corporation, which controls Northeast, advanced $2m in 1957 and about $4m this year; bank loans now stand at $9m; and $7m is still owed to Vickers and Rolls-Royce.

ANOTHER ALTIMETER DISASTER

THE court of inquiry investigating the accident to a Central African Airways Viscount at Benina on August 9 has expressed the opinion that the pilot inadvertently descended below the correct height during approach, the probable cause of this action being "that he misinterpreted the reading of his altimeter." The court felt unable to exclude the possibility "that his efficiency had been reduced by fatigue and a slight indisposition."

The report, which will be fully summarized in next week's issue of *Flight*, was published on December 1 by the Libyan Ministry of Communications.

OPERATING THE BRITANNIA

ONE of the air transport industry's formost authorities on the operation of turbine aircraft, Mr. J. E. D. Williams, was the lecturer at a meeting of the Bristol branch of the Royal Aeronautical Society on Thursday, December 4. Mr. "Jed" Williams is consultant to El Al, C.P.A.L., Aeronaves and Cubana. His subject was the operation of the long-range Britannia, and *Flight* hopes to summarize this important lecture in next week's issue.

CIVIL AVIATION . . .

EX-IM BANK AND AIRLINER CREDITS

SO much has recently been said about the activity of the Export-Import Bank of Washington that it is relevant to describe the general policy of the Bank in relation to the financing of airliner sales.

Unlike the Export Credits Guarantee Department of the Board of Trade, the Ex-Im Bank does not insure exporters against default but extends credit to selected foreign importers of American goods. The selection process is based upon the submission to the Bank of a claim for credit—the submission usually being put forward by the American manufacturer involved. Such loans are known as "Exporters Credits" and require that the foreign borrower subscribe a down-payment in dollars covering at least 20 per cent of the total loan. The manufacturer must also agree to cover a similar share, leaving the Bank responsible for financing a maximum share of 60 per cent.

The Bank has established maximum repayment periods for Exporter Credits, and these are currently set at five years for piston aircraft and seven years for turbine aircraft. Most loans in practice cover lesser periods than these. Interest rates vary according to the duration of the credit, the risk involved, and prevailing market rates generally, and the Bank believes that their terms "contain no noteworthy discrepancies from those under which private lenders provide financing for similar purposes."

A second type of loan, known as a "Project Credit," relates not to the purchase of a specific product such as an airliner, but to the broad range of expenditure required to finance a development project. Ethiopia and Indonesia have negotiated contracts with the Ex-Im Bank to cover the development of air transport within each country, and in addition to the financing of airports, terminal facilities and communications systems, these contracts also cover the purchase of airliners. The terms laid down for such Project Credits vary according to the nature of each contract.

DANUBE BLUES

AUSTRIA'S air transport has had troubled history ever since its post-war inception. At one stage the two rival political parties each had its own plans for a national carrier and only after years of debate and negotiation did a coherent plan emerge. Austrian Airlines were formed in April 1956 but did not start operations until last spring. Using four Viscounts hired from Norway's Fred Olsen, A.U.A. achieved the rare distinction—despite the premature claims of T.C.A., T.A.A. and B.E.A.—of being the world's first all-turbine operator.

But traffic has failed to reach expectations, and operations are not believed to have broken even. A particular problem was posed by the delay in publishing the airline's summer timetable. For some months A.U.A. have been investigating the problems of replacing or enlarging the existing fleet, and their directors have in recent weeks been considering an increase in capital to finance expansion and purchase of new equipment.

Meanwhile, lacking the capacity to develop Austria's internal services, A.U.A. has been negotiating with the country's two independent companies, Aero Transport and Austria Flugdienst, with the object of giving them temporary access to the internal routes. The independents are each closely associated with German companies (Aero Transport with L.T.U., Austria Flugdienst with D.F.G.) and were founded earlier this year after restrictions had been placed on the operation of non-scheduled services between Germany and Austria.

U.S. AIRLINES VERSUS C.A.B.

WE referred last week to the fundamental air transport economic issues to which the C.A.B. is at present giving attention. Another issue which the Board will now have to reconsider is airline depreciation policy. The C.A.B. have long felt that the American airlines depreciate their equipment too rapidly, thus burdening the travelling public unnecessarily with the cost of paying for the next generation of aeroplanes. So strongly did the Board feel about this that last year it ordered the airlines to depreciate their equipment over seven years with a residual value of 15 per cent.

The airlines took strong exception to this order, which they regarded as an unjustified interference with internal commercial policy, and appealed to the United States Supreme Court. This court has now decided in favour of the airlines, much to their jubilation. They regard this as a major victory over what many of them feel to be the bureaucracy of the C.A.B., but which many of those who stand on the sidelines regard as being a defeat of a principle which, in the long term, might have been in the interest of the air transport industry. It is a point of view that too high a rate of depreciation is the great *malaise* of air transport at the present time.

ETHIOPIAN EXPANSION

THREE DC-6Bs have quite transformed Ethiopia's national carrier. Since early last summer these aircraft have been operating from Frankfurt to Nairobi via Addis Ababa. Prior to the introduction of the DC-6Bs, E.A.L. operated only as far north as Athens. But now the 6Bs cover the route to Frankfurt three times a week, while the Convair 240s and DC-3s are restricted to the shorter services.

Traffic has increased particularly sharply in recent months and in September was 68 per cent higher than in the corresponding month last year. The airline expects this year to pass the 100,000 passenger mark for the first time. But the financial improvement was even more marked: over the first nine months of this year net profit rose by as much as 92 per cent.

TELEVISION RADAR FOR C.A.A.

NINE scan-conversion units designed to convert P.P.I. displays electronically into television pictures which can be viewed in bright daylight have been ordered by the C.A.A. They are to be delivered by next May for installation in the traffic control centres at New York/Idlewild, Washington National, Chicago/Midway, Los Angeles, Atlanta, Oakland, Detroit and Fort Worth. The ninth unit will be used in the New York centre to display radar information transmitted from the Air Defense Command radar at Palermo, N.J.

The contract is valued at $1,632,638 and has been placed with Intercontinental Electronics Corporation of Mineola, Long Island, N.Y.

The TI 440 scan-conversion unit is based on a two-gun cathode-ray tube and presentation will be on 22-in horizontal and 16-in vertical tubes. Long-persistence characteristics allow recording of aircraft tracks as well as positions.

The last week of November saw each of the first two really intercontinental civil jets emerging. The Boeing 320 (right), seen waiting on the flight apron at Renton on November 24, will be delivered to Pan-Am. Also powered by the Pratt and Whitney J75, the first intercontinental DC-8 (upper picture) carried out its maiden flight on November 29 at Long Beach

PROSPECTS FOR EAGLE

AT first sight there may not appear to be anything especially significant about a recent application made to the A.T.A.C. by Eagle Airways (Bermuda), Ltd., to operate a normal scheduled service between Bermuda and London. With intermediate technical stops at Gander and/or Shannon or the Azores and/or Lisbon, the service would be operated with DC-6A/Bs or Britannias at an initial frequency of three return flights weekly, increasing later to seven return flights weekly, for ten years from the date of approval.

The significance of the application lies in the fact that the company, as the Bermudan designated flag carrier, has already received approval from the Bermudan Board of Civil Aviation to operate these routes to London, as well as services from Bermuda southward to Antigua, Barbados and Trinidad and south-westwards to Nassau and Jamaica. It would seem that Eagle stand a fair chance of being the first of the independents to operate a regular, scheduled transatlantic passenger service. Mr. Harold Watkinson's words at the recent B.I.A.T.A. annual dinner on the subject of a new Air Transport Advisory Council with "new powers, revised and wider terms of reference and wider discretion" are significant in this connection, although much naturally depends on the results of the next general election. But one of the conditions of approval made by the Bermudan authorities is that a London service must be in operation not later than July 1, 1959.

An Eagle service to Bermuda would compete with B.O.A.C.'s Britannia 312 services; there are at present four of these a week, two of which go on to Caracas *via* Bridgetown and Port of Spain, the other two calling at New York and going on to Nassau and Montego Bay. The proposed Eagle service would also compete indirectly with those of three carriers who operate once-weekly services from the Caribbean area through Bermuda to Lisbon and Madrid with Super Constellations; Cubana's from Mexico City and Havana, Iberia's from Havana, and Linea Aeropostal Venezolana's from Caracas and on to Rome.

An interesting point is that, while Cubana already has four Britannias and two 707s on order, Iberia has just recently shown an interest in the Comet 4 and L.A.V. is a potential purchaser of three Comets and "several" Britannias. The benefits of definite approval to operate a route to Bermuda would not be confined to Eagle alone, but could also extend to de Havilland and Bristol, since the prospect of turboprop competition from another British carrier might be a deciding factor in making Iberia and L.A.V. choose Comets and Britannias, while Eagle itself can now be regarded as at least a prospective Britannia customer.—M.J.H.

de Havilland arranged for Mr. Aristotle Onassis to fly in a Comet 4 last week from Nice to Hatfield. Left to right: Mr. Onassis, Mr. H. Shaw (de Havilland airline liaison) and Mr. John Cunningham (chief test pilot and director)

BREVITIES

Capital Airlines have applied to the C.A.B. to lease three Viscount 810s from Continental Air Lines. These aircraft will fulfil Capital's increased-capacity requirements following the award of a route to Florida. Capital's present fleet consists of Viscount 745s.

* * *

Varig intend, subject to government approval, to increase their Caravelle order from two to five aircraft.

* * *

The runway at Ferihegy, the main Budapest airport, has recently been extended to 9,975ft.

* * *

Philippine Air Lines are due to open their Manila - Tokyo service on January 1.

* * *

T.C.A. are planning to start scheduled services between Montreal and Vienna within the next few weeks.

* * *

American Airlines have abandoned their requirement that passengers holding return- or through-tickets must re-confirm their reservation.

* * *

Under an agreement with Air France, Royal Air Cambodge are now operating Super Constellations instead of Boeing 307 Stratoliners on their Pnom-Penh - Hong Kong service.

* * *

Panair do Brasil have leased four DC-6Bs from Loide. Of Panair's 14 DC-3s ten have been sold to P.A.B. and four to A.L.A. (Aerotransporte Litoral Argentine).

* * *

C.S.A., the Czech airline, have confirmed reports that they are planning to purchase a fleet of Ilyushin Il-18 Moskvas. They will be delivered in the third quarter of 1959.

* * *

T.W.A. are due to inaugurate their new services linking California and Florida on December 15. Northwest started operating into Miami on December 1.

* * *

Transocean's supplemental service between Honolulu and California has now been extended to Chicago and New York on a twice-weekly basis.

* * *

Pacific Airlines are to purchase six Fairchild-built Friendships following approval by the C.A.B. of a loan-guarantee of $4,631,000. Total cost of the contract is actually $5,145,565. The loan must be paid back over ten years, interest rate being 5¼ per cent. Other potential Fairchild F-27 purchasers are Aloha Airlines, formerly Trans-Pacific Airlines. Three aircraft, plus an option on two, may be bought.

The Port of New York Authority has approved the operation of the Lockheed Jetstar at New York International.

* * *

The Il-14 presented by the U.S.S.R. to the King of Nepal has now been delivered to Katmandu.

* * *

B.K.S. have acquired a Bristol 170 from B.O.A.C. This aircraft was previously operated in the Lebanon by M.E.A.

* * *

B.O.A.C. were due to resume operations through Tripoli on certain London - Lagos services from December 9.

* * *

Iraqi Airways are reported to be negotiating for the purchase of unspecified jet aircraft.

* * *

Transcontinental and R.E.A.L., who recently arranged a pool-agreement on U.S. services, have now integrated their flight schedules.

* * *

Two Il-14s, built in East Germany, have been delivered to Peking for use by China's national airline. Several more are due for delivery.

* * *

An account of Amsterdam's international airport, written by Hugo Hooftman, has recently been published by A. W. Bruna and Son, Utrecht, under the title *Hier is Schiphol*.

* * *

It is reported by *Aviation Daily* that Hawaiian Air Lines are likely to convert four Convair 440s to Allison 501 turboprop power. This is the first reported interest in the Allison-Convair conversion; it would cost Hawaiian about $500,000 per aircraft.

* * *

B.E.A.'s summer fares on internal services to Jersey, Guernsey and the Isle of Man will be in force next year for only about three months. During the past year, when traffic on these routes was disappointing, the summer fares applied for a four-month period.

* * *

Rolls-Royce of Canada and Pacific Airmotive of Burbank have agreed that the last-named company shall become the distributor and overhaul facility for Rolls-Royce Darts at Burbank. It is reported that Piedmont, a new F-27 operator, has contracted with Capital for the overhaul of their Darts.

* * *

Following a similar application by Braniff, National—who were due to become the first U.S. domestic jet airline when they introduced 707s leased from PanAm between New York and Miami on December 10—have applied to the C.A.B. for a surcharge. They want to add $10 to the fare charged to de luxe class passengers.

Promoting B.E.A.

THE SUMMER SALES CAMPAIGN IS NOW UNDER WAY

The "girl on the cover" will become an increasingly familiar figure to those planning holidays in the next few months. (Right) Together with leaflets advertising specific routes is the new brochure inviting a winter break. The "double square" is a feature of B.E.A. design

ONE of the few general rules about the advertising world is that the less a product is taken for granted the more heavily it must be advertised. In the U.S. only one person in ten has ever flown on a regular air service. In Europe this proportion is certainly below one in twenty. Among non-fliers there is still a surprisingly widespread belief that air travel is expensive and somewhat perilous and that foreign travel—although romantic—is complicated by strange languages, unusual customs and awkward situations.

For an airline such as B.E.A., which is exclusively a European operator, these facts imply an energetic selling-programme. But this is only one of many unusual traffic problems that the Corporation has to overcome: it is faced with competition from different rivals on almost every single route; and its activities are primarily international in character. This demands energetic diffusion of effort over a wide area. Another problem is the unusually short-haul character of the traffic—the average journey lasts less than two hours; so airline and passenger have little time to get to know each other.

All these considerations suggest that B.E.A. would be justified in spending an above-average amount on advertising and publicity. As the typical level of airline expenditure on such items is between 3 and 4 per cent of revenue, B.E.A. could fairly be expected to spend at least 5 per cent; but in fact the £½m that is currently spent on advertising and publicity every year represents only 2 per cent of revenue. And B.E.A.'s advertising people do not feel that their department is meanly treated. Indeed, their advertising manager, A. J. Burkart, expresses his satisfaction that the 2 per cent allocation is so low, arguing that such a figure is an index of the productivity which B.E.A. and their principal advertising agents, Colman, Prentis and Varley, have achieved.

If there is a reason for this productivity, it is almost certainly that every item of B.E.A.'s advertising is purposeful. Their philosophy is that it is not just promoting air travel, but is selling a specific aspect or service of B.E.A. to a specific customer. Accordingly, the year's activities tend to be divided into several distinct campaigns.

The biggest single selling campaign of the year is the programme aimed at the summer holiday market. The spearhead of this campaign is an attractive and colourful 32-page booklet which describes the places served by B.E.A., and provides comprehensive information on the prices and details of their agents' all-in tours. Here the customers in mind are those who are unfamiliar with air travel and more particularly those whose holiday budgets are tightly planned. An advertisement will appeal to this group only if its subject-matter "rings a bell"; the potential inclusive-tourist must be able to identify himself (or possibly more important, herself) with the person shown in the advertisement and must also be personally attracted by the general setting and the background. Each year the cover of the booklet is improved, and provides the central *motif* for the summer campaign. B.E.A.'s research has shown that summer holiday plans are usually concocted in the early spring, and for this reason the summer programme is launched as soon after Christmas as possible. An integrated campaign, making use of all available media, strives to reach as wide a market as possible.

At the present time of the year B.E.A. is waging a second sales campaign. This is to encourage people to travel during the winter months. In past years the airline has concentrated on emphasizing the attractions of snow and sun, but this winter a new theme has been developed: that it is now the time to "break away"; that rather than feel guilty at taking a holiday in the winter, the hard-pressed workers of the world have a duty to their fellows, their families and to society to get away and find "the change of outlook and refreshment you know you need—and deserve."

Individual services are advertised throughout the year, particularly through the medium of posters or pamphlets. Such campaigns, each aimed at selling travel to a specific area, are often arranged jointly by B.E.A. and the local tourist board.

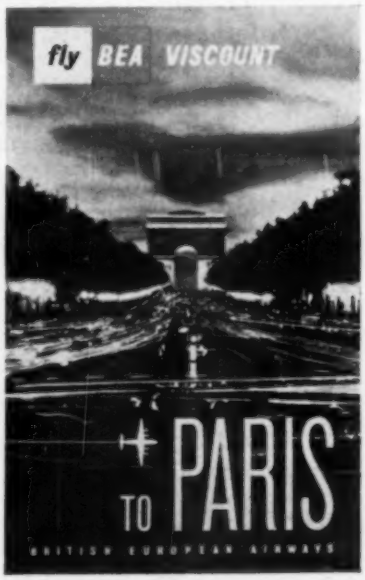
Effective point-of-sale advertising is another important aspect of B.E.A.'s sales promotion, for travel agents are responsible for about two-thirds of total revenue. Agents are kept fully informed of activities and plans and liberally provided with advertising material. Contrary to the general trend in the airline business, B.E.A.'s window displays are tending to become less ornate. Only a few dozen agencies throughout the country are equipped with suitable facilities to exhibit the mountains of machinery of the kind that some operators have recently been devising for display purposes. B.E.A. realize that the most appropriate display for the vast majority of agencies is one that is compact, easily erected and expendable, and it is within this framework that maximum customer impact is sought.

The airline is paying increasing attention to selling itself as an institution. One reason is the growing importance of the North American market; B.E.A. ticket sales in U.S. and Canada are now valued at over £1 million a year. Yet Americans are still heard asking whether B.E.A. is a subsidiary or a division of B.O.A.C.! Much thought has gone into the development of advertisements which will impress people abroad with the stature of B.E.A.

In quite a different sphere—but still selling the institution—are the efforts to attract the notice of the young. Schools are provided with literature and suitable material, and at Farnborough-time a colourful supplement on B.E.A. is inserted into a well-known children's magazine. Another form of institutional advertising is the campaign to ensure that everything associated with B.E.A. bears what John Burkart describes as "a family resemblance." A design manual has been prepared that will, for instance, allow a Turkish signwriter to prepare material in such a way that it will be instantly recognized by anybody familiar with the airline. Much of the credit for the successful development of this idea is due to Mr. John Lunn, the senior industrial designer in the advertising branch.

In essence, B.E.A.'s promotion policy is typical of an enterprise that is increasingly enterprising. J. C. S.

The Paris poster suggests the movement and the night-life that are so much a part of B.E.A.'s most important foreign port of call



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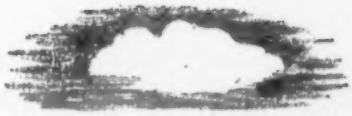

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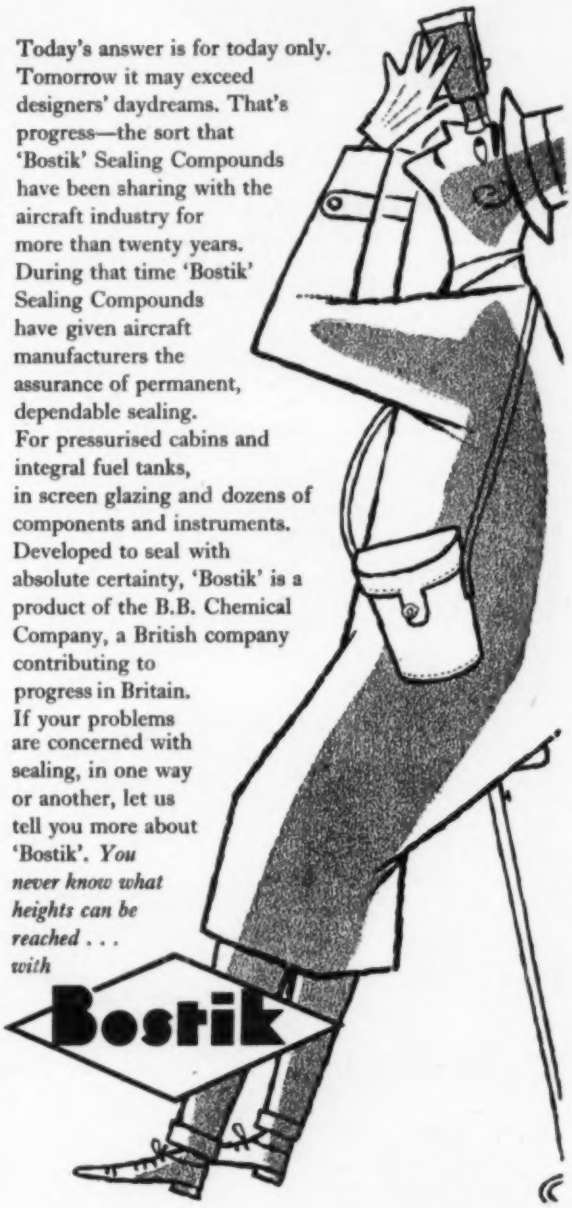

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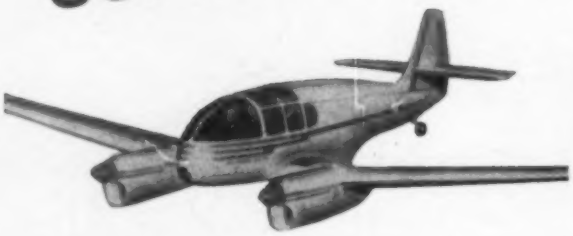

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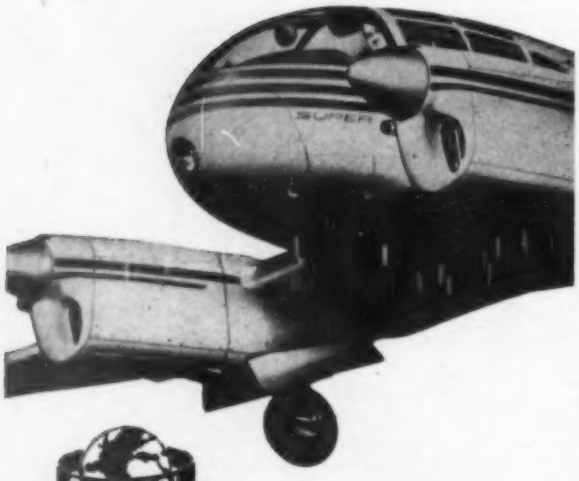

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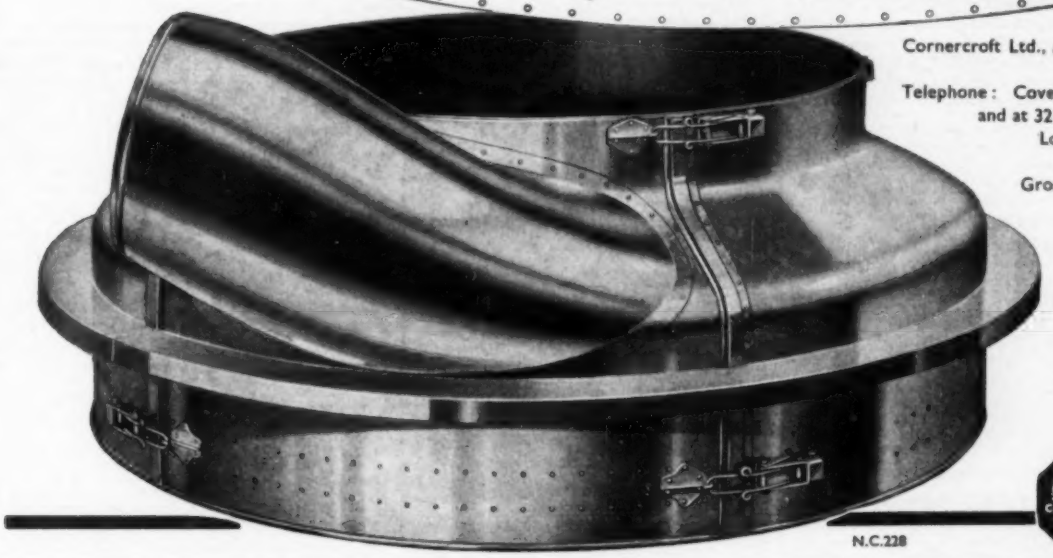

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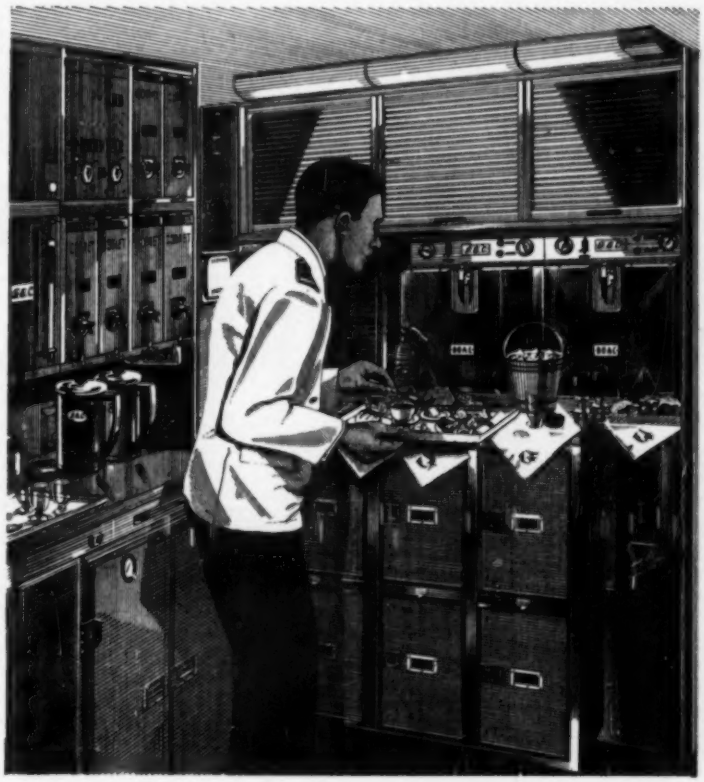

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Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

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The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

PRESS NOTICE
CLASSIFIED ADVERTISEMENTS
December 26, 1958, issue will close for Press first post Monday, December 15, 1958.
Also January 2 issue on December 19, 1958.

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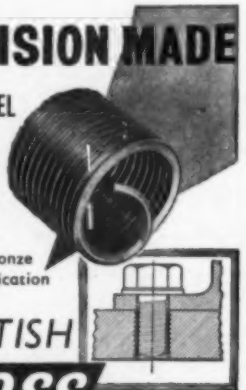

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM Derby Aviation, Ltd., of Derby Airport, Burnaston, nr. Derby:—

FOR the following seasonal Normal Scheduled Services initially with Dakota aircraft and later also with Herald aircraft, for the carriage of passengers and supplementary freight at an initial frequency of two return flights weekly on each service increasing later in accordance with traffic demand from April to October each year for seven years from 1959:—

APPLICATION No. 2370 on the route Cardiff (Rhoose) and/or Bristol (Lulsgate Bottom) - Lyons (technical) - Nice.

APPLICATION No. 2371 on the route Cardiff (Rhoose) and/or Bristol (Lulsgate Bottom) - Toulouse (technical) - Palma.

APPLICATION No. 2372 on the route Cardiff (Rhoose) and/or Bristol (Lulsgate Bottom) - Nantes (technical) - Perpignan.

APPLICATION No. 2373 on the route Cardiff (Rhoose) and/or Bristol (Lulsgate Bottom) - Luxembourg.

APPLICATION No. 2083/1 for an amendment to the terms of approval of the U.K. Internal Service which they are authorised to operate on the route Derby (optional) - Staverton - Bournemouth (Hurn) (technical) - Jersey at a frequency of three return flights weekly with Dakota aircraft or six return flights weekly with Marathon aircraft, until 31st October, 1964, so as to permit them to operate on the route Derby and/or Staverton and/or Oxford - Bournemouth (Hurn) (technical) - Jersey.

APPLICATION No. 143/10 for an amendment to the terms of approval of the U.K. Internal Service which they are authorised to operate with Dakota and Marathon aircraft on the route Nottingham (Tollerton) and/or Derby (Burnaston) - Wolverhampton (optional) - Birmingham (Elmdon) (optional technical from April to October, optional traffic from November to March) - Northampton (Sywell) (optional) - Southampton (Eastleigh) (optional technical) - Guernsey (optional) - Jersey, at a frequency of 18 return flights weekly, of which not more than 14 shall be operated on Fridays, Saturdays and Sundays and not more than four between Mondays and Thursdays, so as to permit them to operate to and from Guernsey and/or Jersey.

APPLICATION No. 1604/1 for an amendment to the terms of approval of the seasonal U.K. Internal Service which they are authorised to operate with Marathon, Dakota and Herald aircraft on the route Cambridge - Luton (optional) - Bournemouth (Hurn) (technical - Jersey, at a frequency of seven return flights weekly, from March to October each year until 31st October 1964, so as to permit them to operate on the route Cambridge and/or Luton - Bournemouth (Hurn) (technical) - Jersey.

FROM Morton Air Services, Ltd., of Croydon Airport, Croydon, Surrey:—

APPLICATION No. 2375 for a U.K. Internal Service with Heron and Dove aircraft, for the carriage of passengers, supplementary freight and mail on the route London (Croydon) or London (Gatwick) - Brawdy, at an initial frequency of two return flights weekly, increasing later to seven return flights weekly, for 10 years from date of approval.

FROM British Overseas Airways Corporation of London Airport, Hounslow, Middx.

APPLICATION No. 2378 for a Normal Scheduled Service with DC.7C and Britannia aircraft, for the carriage of passengers, supplementary freight and mail, between London Airport and Frankfurt, at an initial frequency of 11 return flights weekly, increasing later to 14 return flights weekly, for seven years from 1st June, 1959.

FROM Orion Airways, Ltd., of Blackbushe Airport, Camberley, Surrey, for the following Normal Scheduled Services with Viking aircraft, for the carriage of passengers, supplementary freight and mail, at an initial frequency of one return flight weekly on each service, increasing later to seven return flights weekly for seven years from 1st May, 1959:—

APPLICATION No. 2376 for a seasonal service on the route Coventry - Lyons (technical) - Rimini from 1st May to 31st October each year.

APPLICATION No. 2377 on the route Coventry - Lyons (technical) - Genoa.

FROM Eagle Airways, Ltd., of 40 Edgware Road, London, W.2:—

APPLICATION No. 785/2 for permission to operate with DC.6A/B aircraft in addition to the types already approved on the following Normal Scheduled Services: London Airport and/or London (Blackbushe) - La Baule (Montoir) - Saragossa (San Jurja). London Airport and/or London (Blackbushe) - Dinard.

(continued at top of column 3)

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PUBLIC ANNOUNCEMENTS

(continued from bottom of column 1)

APPLICATION No. 1717/1 for an amendment to the terms of approval of the seasonal Normal Scheduled Service which they are authorised to operate on the route London Airport and/or London (Blackbushe) - Lyons (optional technical) - Rimini, at a frequency of four return flights weekly, with Viscount aircraft or eight return flights weekly with Viking aircraft from April to October each year until 31st October, 1964, so as to permit them to operate also with DC.6A/B aircraft at frequencies of four return flights weekly and to operate on the route London Airport and/or London (Blackbushe) - Lyons (optional technical) - Rimini or Forli.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [8562

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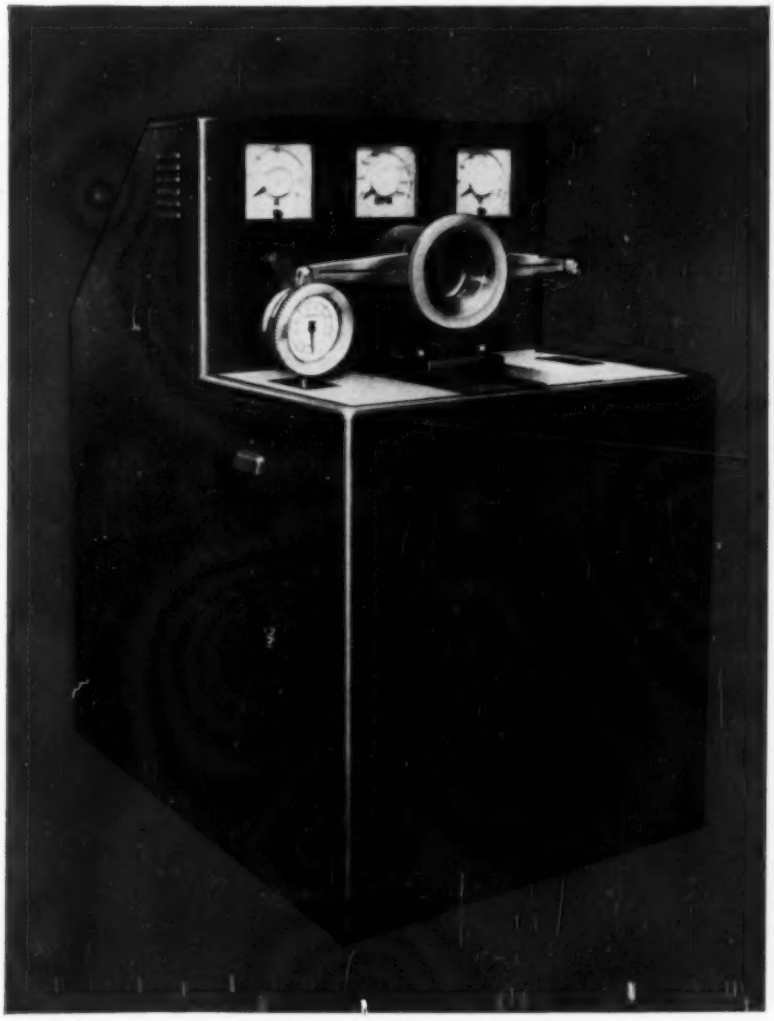

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